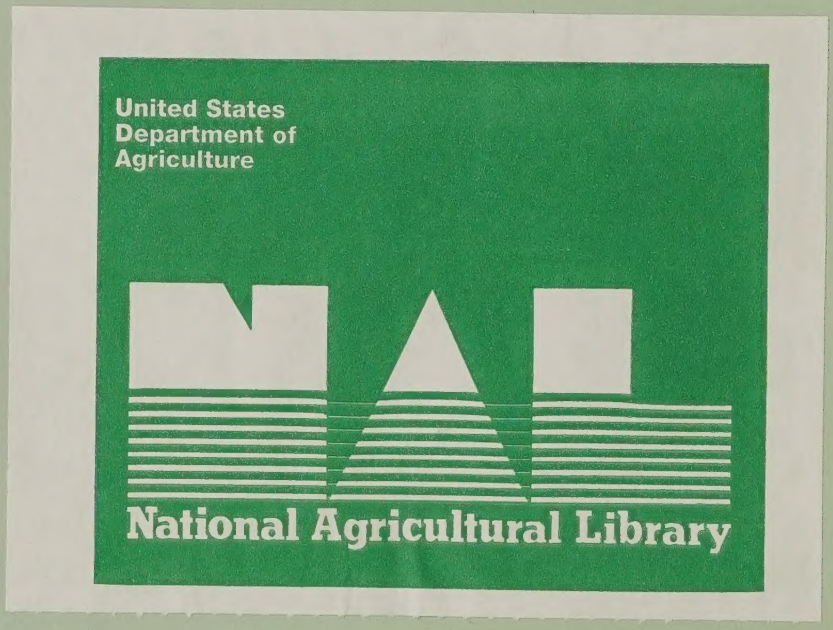
REPORT OF PROCEEDINGS

North Central Region

LIVESTOCK SPECIALIST CONFERENCE

May 23-25, 1961
at
Fort Robinson Beef Cattle Research Station
Crawford, Nebraska

UNITED STATES DEPARTMENT OF AGRICULTURE
Federal Extension Service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NORTH CENTRAL REGION LIVESTOCK SPECIALIST CONFERENCE
Fort Robinson Beef Cattle Research Station, Crawford, Nebraska
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Tuesday, May 23

Chairman - Robert E. Jacobs, Minnesota

8:00 a.m. - Registration

8:30 a.m. - Welcome - Director E. W. Janike, Nebraska; James S. Ingalls, Superintendent, Fort Robinson

8:45 a.m. - The Conference Program - Assistant Director M. W. Soults, Iowa

9:00 a.m. - Identifying Our Role --
As a Livestock Producer Sees It - Ralph Raikes, Nebraska
As an Allied Industry Representative Sees It - Dr. Damon Catron, Walnut Grove Feeds
As an Extension Administrator Sees It - Director E. W. Janike, Nebraska

1:15 p.m. - Group Discussions on "Role"
(Divide into three groups and rotate each speaker to each group)

Discussion Leaders:
Robert Jacobs - to rotate with the Livestock Producer
William Zmolek - to rotate with the Industry Representative
Paul Guyer - to rotate with the Director
(change at 2:15, 3:15, and 3:45)

6:00 p.m. - Dinner -- Lloyd G. Tanner, University of Nebraska Museum

Wednesday, May 24

Chairman - Henry H. Mayo, Indiana

8:00 a.m. - Livestock and Carcass Evaluation in Relation to Livestock Improvement Programs - Dr. A. M. Pearson, Michigan

9:00 a.m. - Livestock Improvement Programs (group sessions)
Beef Cattle - Dr. K. E. Gregory, USDA, Advisor; Harry Russell, Discussion Leader
Swine - Dr. L. N. Hazel, Advisor; Wilbur Bruner, Discussion Leader
Sheep - Dr. C. E. Terrill, USDA, Advisor; Fred Giesler, Discussion Leader
(30-45 minute presentations followed by group discussion)

Wednesday, May 24 (continued)

Chairman - Ray Arthaud, Minnesota

1:00 p.m. - Fort Robinson Research Program - Dr. K. E. Gregory, USDA

2:00 p.m. - Tour of Station - James S. Ingalls

5:30 p.m. - Barbecue

8:00 p.m. - New Approaches in Livestock Extension Programs
- Beef Cattle - W. W. Wharton, Discussion Leader
- Swine - G. R. Carlisle, Discussion Leader
- Sheep - James E. Ross, Discussion Leader
- 4-H - D. C. Williams, Jr., Discussion Leader

Thursday, May 25

Chairman - Leo E. Lucas, Nebraska

8:00 a.m. - Business Meeting

8:15 a.m. - "On The Farm" Production of SPF Swine - Dr. George Young, Nebraska

9:30 a.m. - Regional Efforts - Charles E. Bell, Jr., FES, USDA

10:15 a.m. - Group Discussion on Regional Efforts
- Beef Cattle - George E. Strum, Discussion Leader
- Swine - LaVerne J. Kortan, Discussion Leader
- Sheep - Donald Walker, Discussion Leader
- 4-H - Tom W. Wickersham, Discussion Leader

12 Noon - Adjourn

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ROLE OF THE EXTENSION LIVESTOCK SPECIALIST
As A Livestock Producer Sees It 1/

I appreciate this opportunity to speak to you today as a substitute for Bob Buck. It gives me an opportunity to say some things that have been on my mind for a long time -- and at the same time it gives you an out. You can always say that if you had had the speaker you had hoped to have in the first place, you would have had a better program.

First, I'm going to make a confession. I haven't had very much contact with the Extension Service in recent years. Perhaps this is my fault -- perhaps it's the fault of the Extension Service. At any rate it puts me in something of a disadvantage so far as discussing what Extension should or shouldn't be doing. On the other hand, I have some definite ideas about what I, as a livestock farmer, would like to get in the way of information and service from the Agricultural Extension Service.

Along with some other agricultural agencies, the Extension Service has been under fire in recent years. Criticisms have been flung from every direction. How many are justified and how many undeserved, you know better than I. For you, whose very livelihood is dependent upon your jobs in Extension, perhaps my thoughts will provide some stimulus to improve the service. I'm aware of your problems -- budget, personnel, lack of interest on the part of your farmer committees. There's no question that you have problems.

I think of a story I heard of a particular time in the history of the Standard Oil Company when things weren't going at all well. At a company conference, everyone was talking about their insurmountable problems until finally the president declared a moratorium on problems. "From now on there will be no talk about problems. We will only speak of opportunities." The next day during the discussion a little fellow in the back row stood up. The president misspoke for an instant and said "What about you, what are your problems?" The little fellow answered, "Oh, I don't have any problems--but I sure do have a mess of opportunities."

I would suggest to you today that the Extension Service has a "mess of opportunities" and we must be constantly looking for solutions.

Let me give you an example of some expressions I have heard from farmers recently regarding Extension. One farmer whom I had told of my assignment here volunteered this uncomplimentary statement. "You asked the right fellow," he said. "I was up to see my county agent a few days ago and was never so disappointed in my life. I was interested in learning something about farmstead planning, and also wanted information on installing an automatic feeding system for my cattle -- and he had nothing to offer." "In fact," this farmer said, "about all they ever do, as far

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1/ Presented by Ralph Raikes, Livestock Producer, Ashland, Nebr., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

as I'm concerned, is work with 4-H Clubs. I have four children, and don't want any of them to be farmers, because we have too many farmers already, so the Extension Service isn't of any use to me at all."

Another farmer I know, a graduate of the College of Agriculture, who taught a veterans class for a while said he thought there was some sort of board responsible for the Extension Service activities in his county, but he wasn't sure. Both of these men are good livestock farmers -- but for some reason or other the Extension Service isn't meeting their needs.

You might say, they aren't typical -- that Extension is doing a good job for many people. This may be so. But I think we had better seriously examine what is being done and what can be done to improve the situation. I'm sure you'll agree that if only a small number of farmers feel as these men do that Extension has a "mess of opportunities."

When I talked with Ed and Paul about being on this program, they said I should state very plainly what I thought and what I would like to receive from the Extension Service. Well, there are a lot of things I want, but first let me tell you a little bit about our operations. We feed cattle, raise hogs, have a Grade A dairy, and also have a flock of layers and sell Grade A eggs. In addition to that we produce certified seed, seed corn, and small grains.

You might say this is a diversified farming operation, but we don't consider it such. We are striving to specialize in each of these several areas and to do just as efficient a job as someone who is specializing in only one. It is our general principle to try to make a finished product out of everything that is grown on the farm, so our products are marketed as beef, pork, milk, eggs or seed. Every year we "lick the platter clean." We feed all our grain and usually buy some in addition.

We have made improvements in almost every phase of our livestock operations in the last few years. We put up quite a large quantity of silage, feed our cattle by means of a modern feed wagon which mixes the hay, grain silage and protein supplement and puts it into fence-line bunks. We're just now completing the sow lots as a part of the multiple farrowing system we started a couple of years ago. Our farrowing house has electrical radiant-heated floors, and a double-vent air-conditioning system that works well in both winter and summer. I was unable to obtain plans for such a layout from either of our two nearest land grant colleges and we finally got plans from a commercial firm by paying a use fee. Adjacent to the farrowing house we have a pig nursery, and after six weeks there, pigs are turned out into adjacent fields. We've been working on improving our Grade A dairy by using DHIA service and now have a fairly high producing herd. I say these things, not to impress you that we are necessarily doing things right, but to emphasize the general need for farmers to constantly improve if they are to compete in this rapidly moving game of agriculture.

So you see, I need lots of help in making improvements in both our physical plant and our livestock operations. We are perhaps not typical of many of the livestock operators you work with, but I'm sure that most of us are faced with similar problems. We mix practically all our own feed, and I

have resisted every attempt for anyone to sell me on the idea that they should take on part of that program for me. Since we buy our ingredients mainly in bulk and at fairly low prices, using antibiotics, premixes and all the other recommended ingredients, and since our livestock seem to do well, we plan to keep on as we are. But we know we must keep up with the progress in modern feeds and feeding. Are we going to get the information we need from the Extension Service?

I have the feeling that commercialism has crept into the livestock feed business to such an extent that many farmers aren't sure what is right and what's wrong. Have feed salesmen been taking over in an area of information that should be provided by livestock extension specialists? With the tremendous competition in the feed business, I fear that there may be a tendency on the part of many salesmen to misinform, if need be, in order to make the sale.

So far the feed salesmen haven't impressed me, but I know they are getting through to a lot of farmers.

We need to be sure that when new information becomes available from our experiment stations, that farmers are the first to receive it. One of the most significant changes of all in farming and livestock production in the past decade has been the change in the attitude of farmers and stockmen toward change itself. Producers no longer have to be "sold" on new ideas. We are ready for them. We are receptive to new and better ways, and aren't reluctant to change methods if you can show us it will pay.

This in itself represents real progress. When you consider it took more than 15 years for farmers to accept hybrid seed corn--when all they had to do was dump a different seed bag in the planter--but it has taken only a half dozen years for them to accept field shelling, especially when you consider the high investment required to convert to field shelling.

One county agent in one of our plains States admitted that he was astonished at the terrific rate of conversion to hybrid milo, with the conversion taking place in his area in only two seasons, with a doubling of the average yield of milo in his State in five years.

Any plans that are made for improving future service by the Extension Service should be carefully thought out so that they coincide with the rapid changes in agriculture. Let me illustrate: Bill and Luke were good friends. They occasionally hunted together. One cold snowy morning they went out together, crawled into their blinds, and patiently waited for the ducks to come over. Luke was a teetotaler, but Bill liked his liquor, and each had a thermos jug of his favorite beverage.

Bill nipped away at his whiskey, and Luke sat over in his corner and drank hot coffee. Finally one lone duck flew by, directly in front of the blind. Luke let go with a blast that woke Bill, but didn't disturb the duck. Bill jumped up, spun around, pulled the trigger, and the duck dropped not far from them in front of the blind. "Good shooting," said Luke. "Oh, shucks," said Bill. "Ordinarily when I shoot into a flock that size, I get a half dozen or more."

There must have been enough advantage from Bill's thermos jug to give him the inspiration to shoot far enough ahead so that he at least got the duck, while if he had had his sight squarely trained on the duck when he pulled the trigger, the duck would have been gone before the shot ever got there.

Now I don't necessarily recommend Bill's beverage for tired extension specialists, but I would like to point out that planning ahead means aiming even further ahead. Any plans you would make for today's agriculture would soon be obsolete, just as the realistic aeronautical engineer knows that the plane being designed on his drawing board will be obsolete by the time it gets off the ground.

Any organization that would serve agriculture must realize that our mechanical and technological revolution in agriculture is not over--actually we are only on it's threshold. I expect we will have more changes in the next five years than we have had in the last ten. This means that the job of keeping farmers and stockmen informed will be greater than ever before. It presents a tremendous challenge to you as extension specialists.

I hope that the College of Agriculture events such as "Rooters Day" and "Feeders Day" will be expanded and more information presented in that way. The old Chinese proverb that "A picture is worth a thousand words" has a lot of merit. The additional land which we hope the University will acquire at the Nebraska Ordnance Plant some 20 miles north of the College can be a great asset, not only for obtaining new information through research, but to provide an opportunity for farmers to view livestock on test so that they may get first hand knowledge of what's new.

There are so many questions I would like to have answered impartially and scientifically: What is the real value of high moisture corn? How does its feeding value compare on a per acre basis? Also, does it pay to chop and dry hay as we have done for several years, or would we be justified in putting up airtight storage--and can I feed wet hay from such a structure? I would like to know the uncommercialized and unvarnished truth about the value of feeding mineral to cattle as well as antibiotics and vitamins. I want to know how to best construct an automatic feeding system that will work completely by power from storage to feed bunks--and I certainly need advice on this project.

These are just a few of the many questions I and other livestockmen have. Probably we don't have the answers to some of these questions. Getting the answers is the responsibility of the Experiment Station. Once the answers become available, however--your task of disseminating the information becomes all-important.

We have questions about hog raising that are just as searching and just as important, if we are to do the best job of producing pork in Nebraska.

I have a suggestion that might be of some help in organizing and planning for the dissemination of information. Already we have established that farmers want to know! If groups of not-to-exceed 25 farmers were selected and organized, men who would want to be part of a dynamic group interested

in the problems of profitable cattle feeding, you as specialists could make good use of your time in serving as resource persons or advisors to the group. The members of the group or an executive committee could determine the programs to be presented.

This could result in continuing adult education in fields which are of great interest to livestock men.

The economics of the livestock business is another area where we need help. I have been disappointed as I visit other States that Nebraska has not had the foresight to organize farm business associations which could supply technical assistance in record analysis, outlook and planning.

In some States these have become self-supporting and have broken their ties with the Extension Service, but the important part played by Extension in getting them underway shouldn't be underestimated.

It has been said that there are three kinds of people in the world.

First kind says, "Here I am. So what? I didn't ask to be born." He is of little use to himself or others.

The second kind says, "Here I sit. So there!" He is so comfortable in his little groove that he won't move. He's afraid to face the world so he fails to live up to his potential.

The third kind says, "Here I stand. Ready to learn--ready to help--ready to serve." He is a growing person who never says, "I can't." Instead he says, "I'll try." He's not satisfied with the status quo, which really means when it is translated from the Latin--the mess we're in.

My suggestion to you as extension specialists is to make sure that you are in the third classification. If you are, we need you. And you can be of great help to us who are the livestock producers in the Midwest.

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ROLE OF THE EXTENSION LIVESTOCK SPECIALIST
As An Extension Administrator Sees It 1/

To understand an administrator's appraisal of a specialist we need to understand the objectives of the Cooperative Extension Service and the changes which occur to influence the type of staff members that can help meet the objectives.

Basically, the Extension Service is responsible for carrying the results of research and teaching in agriculture and home economics to those who are not resident at the land-grant colleges. We also are the educational arm of the U.S.D.A. We recognize our responsibility is primarily to farm families, but not to them alone. Through our educational outlets, we have a responsibility to help the family achieve and maintain a satisfactory way of life. As times change and new developments take place, we ought to be ready to change with the times and upgrade our programs. If we do not, our clientele look to other sources for their information.

Occasionally, I hear someone say that the extension specialist is on the way out. A common example is the poultry industry. Integration can go to the extent that all control and educational direction stems from the controlling head of the organization. The operation becomes so specialized that management feels it must direct all activities. Since management does control the direction so closely, it has the means to control the educational activities.

Moves in this direction are taking place in the swine and beef industries. However, I doubt that individual operators are going to be willing to accept this approach as the solution to successful livestock operation. The livestock man has been and is typically an individual operator and he likes this independence. He will hold to it as long as he can and there are many examples of successful operations. We have a responsibility to help him with his management problems and to be so skilled that we perform the services he needs. A good business enterprise continually takes stock of itself to maintain its goods and services to meet the needs of its customers. We need to do the same. Farming and ranching have changed rapidly. We used to deal with a clientele made up of farm families operating diversified farms. On the typical farm in Nebraska there was corn, wheat, other small grains and alfalfa. There was a flock of chickens, a few milk cows, some hogs and perhaps a few cattle on feed. The county agent knew enough about a variety of subject matter fields to keep most of his families supplied with answers. It was relatively easy for the specialist to supply the agents with the information they needed and to help them with enough basic meetings and demonstrations to do a good job.

This has all changed. The trend is to specialization, high investments, high operating costs, narrow profit margins and operators well trained in

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1/ Presented by E. W. Janike, Director of Extension Service, University of Nebraska, Lincoln, Nebr., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

their own vocation. The top feeders or breeders are better informed in their subject matter lines than the county agent. True, there are still a great number of general operators who can be serviced in a general way, but the future successful operation is going to be more and more specialized. (It is this specialized group which says we are not meeting its needs.)

If we meet the needs of the progressive livestock operator, we must provide more specialized help. In Nebraska I think we can best do this through county combinations and through area specialists. In either case, the staff out in the field is going to specialize more in certain lines. Here in the Sandhill area, I think we could meet the needs in a relatively simple manner. We won't do it by adding more county agents. We will probably locate specialists in the area who can provide personal service through the agents now in the counties. The rancher wants information on grass, cattle and management. Three area specialists could do the job. These people will not be as specialized in their training as are our specialists at the State level. However, with the help of the State specialists, these area people will provide the direct contact and service to people at the local level.

What then do we expect from an extension specialist. In his Ph. D. thesis, a State leader of extension programs listed four major roles for the specialist:

1. Serving as a subject matter consultant and expert on call to county staffs, organizations and individuals.

2. Teaching people in the State through meetings and individual visits, and by training local leaders.

3. Training agents to keep them up to date on subject matter and its application.

4. Acting as a liaison person to bring the needs for research and studies from the field to those doing research.

These are four good basic roles and most of us would enlarge on them. I feel that all staff members in the Cooperative Extension Service have the responsibility to understand and play a part in the overall objectives of the service.

To fit their roles, specialists will need to pay attention to several areas. Here are some specific things they will need to do:

Know Subject Matter

The specialist at the State level will probably need to "specialize further" his training within a field. This means someone on the staff will concentrate on nutrition, someone else on breeding, etc.

Keep Up to Date on Subject Matter

Good communication is needed with college departments between those in Extension and those in research and teaching. Some colleges have developed a team approach whereby those doing research, teaching and Extension in a given area spend a good deal of time working together. Specialists themselves have said the three most important things to do to keep up to date are:

1. Enroll in formal classes for advanced study.

2. Read the professional research journals.

3. Attend professional meetings.

Be Professionally Competent

Specialists at the State level should have an advanced degree, preferably a Ph. D. This is necessary to be well trained, to keep up with research and to be comparable to those who teach and do research (academic prestige).

We are trending toward more area specialists - people who can serve the specialized producer and feeder closer to his headquarters. I visualize more area specialists serving several counties or a special area (like the Sandhills). These people need at least a MS degree.

Training needs to include some "specialties." The very nature of a specialist's work requires abilities and training in communications, educational psychology, sociology and similar areas which enable one to work with people and understand their problems.

Write Effectively

The interpretation of research for public consumption and for county staff members is one of the most important jobs of a specialist. This is the area where his weakness often shows. Ability to interpret and to write in an understanding way is an important standard in measuring the worth of a specialist. You do not serve needs by just knowing the answers. Your customer wants someone who can answer his questions and with whom he can visit, but he is also willing to read and interpret for himself.

Be a Good Trainer

Specialists still give a great deal of their time to training the county staff. Getting information to staff members in a way that they can understand and in turn apply it in their work requires communications skill. In counties, where staff is limited, we cannot expect agents to be specialists in all fields. They can handle a good many of the basic principles, but they will have to depend on reference material or specialists' help to answer the more complicated problems they are facing.

Have a Good Broad Understanding of the Overall Extension Program

All specialists need to understand the part coworkers play in the overall program. Public policy, family living, community development, management and other related areas are important. You need to recognize that the people you work with have interests in all these areas not just in yours.

Have an Understanding of the Practical Operation of the Livestock Unit or Livestock Phase of the Unit in its Environment

Marvel Baker, who was associated for a good many years with the Animal Husbandry Department in this State, used to tell me that the value of the information he had for a cattle feeder depended on his knowledge of the feeder and the way he operated.

In other words, the area of management entered the picture quite strongly. When Dr. Baker knew the feed and management situation, he would make his suggestions. The next man, under similar resource conditions, might get an entirely different suggestion.

Be able to develop educational media to reach many specific audiences of people at different educational levels. Good communication by specialists to the different audiences requires a lot of ingenuity.

(Sometimes it is easy to get too far out ahead of the people with whom we are working or to push them too fast. This is particularly true with the key leaders.) In our basic program planning we need to continually counsel with the key leaders to keep them well posted about what we are doing and to seek their advice. Failure to do this may bring negative reactions and serious delay in advancing our work. Specialists, agents and administrators must constantly listen for "feed back" and adjust their programs accordingly. If we do hear about negative reactions we must find out the "why" of these reactions.

A specialist needs the ability to look into the future so he can anticipate problems and opportunities and be prepared to handle them. As someone said, "Use radar rather than a rear view mirror to guide our work." The specialist's leadership role in this respect is extremely important.

Be a Good Team Player

Rarely does the solution of any one problem require technology from just one discipline. It is necessary for specialists from all of the departments within a College of Agriculture to approach problems as a team, to prepare teaching materials together, and perhaps conduct educational activities together. A good example of this might be the planning of a modern feed lot or ranch headquarters. Here the animal husbandman and the agricultural engineer must work together. The agricultural economist also may have a role to play. Teamwork is even more important within your own departmental staff.

Be Alert in the Area of Public Relations

Some of us started as animal husbandry specialists in a field largely to ourselves. We were just about the only connecting link between research and its application on the farm. Today, there are a good many others on the team. The feed industry, the processing industry, farm press, farm managers, bankers and many others provide services which parallel ours. Practicing veterinarians provide special service in the livestock field. You can name others.

Livestock producers and feeders continue to become a smaller segment of our total population. The public, in general, has less knowledge of the livestock industry and its place in our economy. It is essential that all of us, who work as a part of the livestock industry, have an understanding of each others place and respect for the part each plays. We can work together for the benefit of the livestock man and consumer alike.

With fewer livestock men, the organization they belong to and expect to represent them become more important. As specialists, you need the understanding and confidence of the farm and commodity groups to which these people belong. (They are one of the best channels through which you can carry out your educational responsibilities.) This doesn't mean that we endorse the idea that you should serve as secretaries for such groups, but you can work through their officers and committees.

By now, some of you may wonder how an administrator expects to find a specialist who can measure up to the qualifications I have discussed. Rest assured that no person in administration expects to find all these qualifications in any one individual. Many desirable qualities can be brought together on a team basis. Sharing and dividing responsibilities are basic to an effective team of specialists. Some have ability in public relations. Others find this area difficult. It is important that you perfect your skills in those areas where you can make your best contributions and develop an ability to carry out your responsibilities. It is administration's responsibility to work with you and understand your strengths and weaknesses. Working together, we can all gain real satisfaction from our jobs.

The most important thing to remember is that together, we in the Cooperative Extension Service have the responsibility to work with farm people and the agricultural industry to help provide a happy, satisfactory and serviceable way of life.

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LIVESTOCK AND CARCASS EVALUATION IN RELATION TO LIVESTOCK IMPROVEMENT PROGRAMS 1/

Improvement in livestock production to a large extent will depend upon the efforts of the livestock extension worker. This is true whether the improvement be in management, feeding and nutrition, breeding or in carcass improvement through the combined influence of all of these factors. In order to discuss this with you today, it is my aim to attempt to point out first, what the consumer wants in meat, secondly, what we know about the importance of various carcass attributes, and thirdly, their application in livestock improvement.

What the Consumer Wants in Meat

All of us are aware of the fact that the livestock business exists to produce products for human consumption, yet sometimes we lose sight of the fact that the consumer should be telling us what they want. All too frequently, the retailer, the packer, the producer, the college researcher and extension worker make decisions as to what we should be producing without considering the consumer. Failure to consider the consumer will usually result in failure unless we are fortunate enough to blindly make the right choice.

We should make an effort to find out what the consumer wants and then we should gear our production, processing and distributing systems towards meeting these demands. Although I may be wrong, it appears to me that the consumer desires tenderness, flavor, juiciness, leanness and attractiveness, which includes color and firmness, coupled with economy and nutritive value. In making this statement, it should be recognized there is no one average consumer, but the average is merely a composite person who does not really exist. Thus, we may find considerable variation in individual demands, which fortunately give us a market for the variable carcasses that we produce in striving to produce the ideal, which is virtually an impossible combination of traits.

Tenderness

Consumer studies have indicated that tenderness is the most important palatability attribute for acceptance of beef, and while of no less importance appears to generally be less critical for veal, lamb and pork, in view of a more limited variability. Although tenderness can be altered by methods of cooking, aging and enzyme treatment, there still appears to be a demand for naturally tender meat. Unquestionably, high temperature aging and enzyme treatments, whether by dipping, simple addition or by ante-mortem injection methods, such as Swift's Pro Ten beef, have already played an important role in increasing the demand for lower grading carcasses. However, let us look at the factors other than these, which may influence

1/ Presented by A. M. Pearson, Professor of Food Industry (Meats), Michigan State University, East Lansing, Mich., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

tenderness. It has been suggested at times that factors such as conformation, maturity, finish, marbling and muscle structure may be used as indicators of tenderness.

Conformation. According to recent studies by Cole et al. (1959), superior conformation did not result in more tender beef. Jersey steers of poor beef type produced more tender steaks on the average than Angus or Hereford steers of good beef type, whereas, Holsteins were less tender with Brahmans producing the toughest steaks. This data certainly suggests that conformation is unrelated to tenderness.

Maturity. A number of researchers (Helser et al. 1930; Dunsing, 1959; Simone et al., 1959) have shown that younger, more immature beef is more tender. Determination of maturity at the market place is a much more difficult task, and is usually accomplished in the carcass by the appearance of the bone and cartilage of the spinous processes. In a relevant study using rats, McCay et al. (1935) found that ossification of the bone was more dependent upon growth rate than age. In other words, fast growing animals showed complete ossification of the long bones at a much earlier age than slow growing animals. Whether the same thing is true with farm animals is not known. The work of Winchester and Ellis (1957) would indicate that the influence of delayed growth on tenderness of beef cattle for short periods of time did not appear to influence tenderness. Since some 3 to 5 percent of all cutter and canner cows are as tender as young beef, it is obvious that degree of ossification is not responsible for tenderness alone. Nevertheless, the practice of marketing cattle, hogs and lambs at relatively young ages is more likely to produce tender meat.

Finish. Several workers (Saffle and Bratzler, 1958; Batcher et al., 1960) have reported that fatter hogs are more tender as a group than lean hogs, but the effect is not clear-cut and there are notable exceptions. Similarly, the higher grading beef carcasses were more tender on the average in work reported by Cover et al. (1958), but in the words of the authors, "Wide scattering of tenderness ratings were observed for animals within a grade. Tenderness ratings were as high for some carcasses in the lower grades as for meat from other carcasses in the higher grades. These observations indicate that carcass grades---were not satisfactory as an exact indicator of tenderness---." In view of consumer objections to excess fatness, it is doubtful whether fattening beyond the amounts needed to permit normal distribution would be advantageous to the industry. Although some consumers are willing to pay for excess fat in order to get some increase in juiciness or tenderness, the trend should certainly be towards a minimum of surplus fat.

Marbling. The amount and distribution of intramuscular fat, commonly called marbling, has been quite generally accepted by the meat trade as an indicator of tenderness. Although there is some evidence over 20 years ago, that the relationship between marbling and tenderness was very low (Hostetler et al., 1936; Ramsbottom et al., 1945), acceptance of the low relationship is relatively recent (Cover et al., 1956). A number of workers have shown that the correlation between marbling and tenderness in beef is low with an "r" value of only about 0.3. Thus, the relationship is disappointingly low for a factor which receives such great emphasis by the U.S.D.A. meat grading

service. Similar work with pork indicates that marbling may be more closely related to tenderness than was true for cattle (Batcher et al., 1960; Harrington and Pearson, 1960), with Batcher et al. (1960) reporting correlations of 0.7 to 0.8. As a further point, Batcher et al. (1960) also found a significant correlation between backfat thickness and marbling. This would logically point out that selection for leanness with complete abandonment of marbling might result in a great reduction in fatness, but simultaneously result in a concommittant reduction in marbling, and could conceivably result in problems in tenderness. Probably the most significant study on marbling of pork was carried out by Kauffman et al. (1961) of Wisconsin, who reported in a store study that the consumers indicated a definite preference for non-marbled chops and would only purchase marbled chops at a reduced price. On taking the chops home and cooking them, the consumers rated the marbled chops higher, but they still continued to buy the non-marbled chops.

Muscle Structure. A number of microscopic studies have been made attempting to relate histological characteristics with tenderness. Joubert (1956) reported that there was a significant difference in muscle fiber diameter between different breeds of cattle. However, attempts to relate muscle fiber diameter to tenderness have shown the relationship to be low (Hiner et al., 1953). Although Hall et al., (1960) found a negative relationship between collagen content and tenderness, other factors appear to be more important from the tenderness standpoint. The development of new methods of fixation, staining and sectioning, along with the electron microscope, have provided powerful new tools for re-investigating the structure of meat under magnification, and may shed light on the significance of muscle structure.

Effect of Exercise. It has often been claimed that exercise will make meat tough, but studies by Mitchell and Hamilton (1933) demonstrated that steers exercised for 181 days were slightly more tender and had less collagen in their muscles than similar unexercised animals. This work was later confirmed by Bull and Rusk (1942). Thus, it does not appear as if exercise will adversely affect meat tenderness, other things being equal.

Flavor

Undoubtedly flavor is the attribute that contributes most to consumer satiety, yet personal likes and dislikes make possible a wide range of variability. Generally, flavor becomes more pronounced as an animal matures, as is illustrated by a comparison of the full flavor of beef in contrast to the blandness of veal. However, it does not appear that flavor differences are apparent in groups of cattle and hogs differing within reasonable age limits. California workers (Simone et al., 1959; Dunsing, 1959) have found no important flavor differences in cattle differing by no more than 12 months of age. Flavor research (Kramlich and Pearson, 1958) indicates that the meaty flavor and aroma of beef is associated with lean tissues, but recent work (Hornstein and Crowe, 1961) suggests that the fatty fraction may be responsible for the characteristic flavor differences between pork, beef and lamb.

Although off-flavors are common with meats and are very serious problems, the subject is too comprehensive for our discussion today. Sex odor in pork, mutton flavor and feed flavors in beef are certainly worth discussion, but time precludes their inclusion.

Juiciness

Certainly juiciness adds to the overall acceptability of meat, yet separation of juiciness from other palatability attributes is difficult. Taste panel work (Cover et al., 1956) has indicated that marbling contributes more to juiciness than tenderness. On the other hand, a good objective measure for juiciness is not available, and its emphasis cannot be properly assessed and applied until such a method is developed.

Leanness

Numerous consumer studies have shown that the housewife will select lean meat when given a choice between cuts differing widely in fatness. In a recent store study involving marbled and unmarbled pork chops, Kauffman et al. (1961) found that 48 percent of the purchasers of the unmarbled pork chops stated their reason for doing so was greater leanness. Another 28 percent of the customers attributed their purchase of the unmarbled chops to appearance. Since it is difficult to differentiate between leanness and attractiveness, it is possible that some 76 percent of all customers purchased the non-marbled chops because they appeared to be leaner.

Attractiveness

Since the advent of the self-service meat counter, the retailer and meat packer have become increasingly aware of the importance of appearance of meat. Color has probably been the most important factor in attractiveness after differences in fatness are ruled out. It is well known that dark, discolored or two-toned watery meat must be reduced in price in order to get the consumer to purchase it.

Hall et al. (1944) reported on their studies on dark cutter beef, which fails to brighten on exposure to air. The color was normally bright at pH 5.6 or below, became shady or dull at 5.7 and at 6.5 or above was dark. Since the ultimate pH of the meat was dependent upon the amount of glycogen present at the time of death, which breaks down to form lactic acid during rigor mortis, it has been possible to greatly reduce the incidence of this problem by preventing undue excitement, feeding and avoiding of exposure of cattle to bad weather during the marketing process.

Two-toned or pale pork has also been related to the glycogen content of different muscles at the time of slaughter. Recently, Briskey and Wismer-Pederson (1961) have indicated the problem is associated with not only total glycogen content, but is greatly influenced by the pattern of glycogen breakdown and pH change.

The question of conformation as related to attractiveness is virtually unknown. Whether a certain shape or muscle thickness may be important from the standpoint of appearance needs to be carefully evaluated. For example,

it may be advantageous to produce a lamb with a large loin eye -- say at least 3.0 square inches of loin eye area. On the other hand, there would appear to be little advantage in placing great emphasis on increasing rib-eye area in beef where a 10 sq. in. value may be large enough, that any further increase in size would likely result in a decrease in thickness of cutting the steaks. From the same standpoint, it would appear to be logical that there is no great advantage in trying to select for loin-eye size in pigs after we achieve a value of 4.5 square inches. At the same time there seems to be no logical reason for penalizing a carcass which exceeds these values.

The Importance of Various Carcass Attributes

Hogs

The characteristics which have been receiving the greatest importance in swine carcasses and selection programs appear to be backfat thickness, length, cut-outs, loin eye area and the use of single or combined cuts as an index of carcass value.

Backfat Thickness. Backfat thickness has been recognized as a good indicator of carcass value for well over 20 years, but just how good has only been determined within the last 5 or 6 years. Breidenstein (1960) summarized some of the information on backfat thickness as a measure of cut-out (either lean or primal) and reported "r" values ranging from about 0.5 to approximately 0.8. However, there are values in the literature as high as 0.9. The accuracy of the method largely depends upon the population, with low values for a relatively uniform group of pigs and the higher values with a wider range of variability.

The live probe developed by Hazel and Kline (1952) has been widely used to measure backfat thickness on the live hog as have other methods including the lean meter (Andrews and Whaley, 1955) and the ultrasonic method (Hazel and Kline, 1959). The live probe has been found to have a slightly but consistently higher relationship to cut-outs than backfat thickness. This is a fortunate relationship and appears to be due to the fact that the probe is taken 1-2 inches off the midline, and thereby reflects true fatness better than backfat thickness which is measured at the midline. Apparently, the spinous processes interfere with readings of actual fat thickness when made at the midline.

Carcass Cut-outs. Carcass value is most accurately reflected by cut-outs. The question as to which cuts should be used has not yet been resolved. The primary point of discussion has been whether to use the 4 lean cuts or include the belly and use primal cuts. The proponents of primal cuts claim inclusion of the belly (a fat cut) provides a counterbalance towards production of underfinished, poor quality carcasses. On the other hand, the supporters of lean cuts point out that improvement towards leanness is slower by the use of the belly, since a high proportion of belly and a high proportion of lean cuts are in direct opposition. Although the question is still unresolved, the tendency has been to use lean cuts because of more rapid improvement in leanness and a lesser number of weights are required.

A similar controversy has existed relative to using the live or carcass basis for calculating cut-outs. The answer is not known at present, although the supporters of the live basis say we should base our measurements on the market practice of selling hogs. On the other hand, the proponents of using the carcass basis claim that it removes the variable of dressing percentage. Actually the final answer can be determined only after we find the heritability of dressing percentage. If dressing percentage should be highly heritable by the use of the carcass basis, we could be selecting against hogs with this desirable trait. If dressing percentage is not highly heritable, it would be advantageous to remove the variables in management which influence carcass yield.

As a final point on cut-outs, it may not be necessary to use the 4 lean cuts, but fastest improvement may be made by selection using only the most valuable cuts, namely, the ham and loin. Recently, some data summarized in our laboratory (Pearson, 1960) showed that the hams and loins make up about 26.5 percent of the live weight but comprise about 55.5 percent of the live value of a U. S. 1 hog.

Carcass Length. Although the breed certification programs all include minimum values for carcass length, there appears to be no scientific data to support the value of length in the carcass. Generally, the relationship between carcass length and cut-outs is low although positive (Breidenstein, 1960), the correlation ranging from 0.1 to 0.3. The data from Lu et al. (1958) on 999 hog carcasses are briefly summarized in the following table.

Correlations of Carcass Length with Different Measures

	Carcass length "r" value	Partial Correlation: Weight held constant length varying	Partial Correlation: Length held constant weight varying
% fat in carcass	0.05	----	----
% lean in carcass	0.01	----	----
% loin in carcass	0.07	0.48	-.58
% belly in carcass	-.12	-.11	0.04

The data indicate that with the possible exception of percent loin, there appears to be no justification for any major emphasis upon carcass length. Data by Tribble et al. (1956) on 64 hogs are summarized below.

Correlation Coefficients for Carcass Length	"r" values
Percent - 4 lean cuts	0.18
Average daily gain (weaning to 200 lbs.)	-0.003

The above data are certainly not indicative of all production factors, but certainly suggest the use of length in evaluation programs must need be justified on some basis other than carcass.

Loin Eye Area. With hogs most of the data indicate that loin eye area is related to cut-out with a correlation from about 0.4 to 0.6. This is a

higher relationship than that found with beef, and thus, eye muscle size may be more important than with cattle. As mentioned earlier there may be little advantage to increasing loin eye size above 4.5 inches, except as cut-out can also be increased.

Single Cut Indices. A number of workers have shown that the ham or loin can be used to indicate leanness (Pearson et al., 1956a; 1956b; 1958a; 1958b; Price et al., 1957). Actually some of the measurements appear promising, but actual data showing the usefulness in selection programs is not yet available.

Beef Cattle

The factors which have received the greatest attention are cut-outs, conformation, rib-eye size, tenderness and quality.

Cut-outs. The use of cut-outs in beef cattle is complicated by the fact that the relative proportions of the various wholesale cuts varies as fattening proceeds. This is best illustrated by the data of Helser et al. (1930), which is shown below in a summary comparing feeders and fattened cattle representing calves, yearlings and 2-year olds.

Effect of Fattening Beef Cattle Upon Cut-outs

	Average values in percent	
	Feeders	Fattened
Dressing %	54.24	63.26
Round %*	14.94	13.96
Loin %*	8.57	10.84
Flank %*	1.76	2.86
Kidney knob* %	0.62	1.96
Rib* %	4.56	5.98
Plate* %	6.09	8.73
Chuck* %	14.28	14.82
Fore shank* %	3.00	2.49

*Percentages are all based on live shrunk weights.

It is apparent from the data that fattening decreases the percentage of round but increases the percentage of rib and loin. Since this is true the problem of comparing data becomes difficult and is only valid at a constant level of fatness.

The Meat Grading Service has recently proposed a revision of the grading standards on the basis of cutability (Pierce, 1959; Murphy et al., 1960). Although the actual grading would be on visual inspection and appears to have an inherent weakness for borderline carcasses to actually be a full grade apart, the use of such procedures in cutting beef carcasses for experimental or evaluation programs in a similar manner appears to have merit. In this procedure the excess fat covering is removed and over-fat carcasses are penalized. Such a procedure would tend to place all carcasses on a more comparable basis, but could also result in some discrimination against the rapid-fattening, fast-gaining steer.

Conformation. As mentioned earlier the importance of conformation from the standpoint of what the consumer desires is not clear-cut. However, information is available on the effects of conformation on percentages of wholesale cuts, although somewhat conflicting in nature.

The effect of conformation or type was investigaged by Wilson and Curtis in 1893. They compared the percentages of different wholesale cuts from 4 beef type and 4 dairy type steers. There was no clear-cut difference in the percentage of low-priced or high-priced cuts in this study. The data indicate that any advantage for the beef type steers would need be based on something other than the percentage of cuts.

On the other hand, Carroll of California (1960) in a letter to me cited research he had completed using 8 Holsteins and 8 Herefords. The cuts were trimmed to no more than 1/2 inch of fat and made into retail cuts with the bone removed from the round. When the shortloin, sirloin, top round, bottom round and knuckle were expressed as percentage of hindquarter weight, the results were as follows:

	Retail cuts as % of hindquarter
Holsteins	61.6
Herefords	66.3
Standard Deviation	1.8

The difference between groups were highly significant and definitely in favor of the Herefords. However, the data of Branaman and Brown (1935) would not support the data reported by Carroll (1960). It is possible that the trimmed cuts and removal of bone may account for the differences in the two studies.

The effect of good versus poor type has been investigated in several studies (Butler et al., 1956; Butler, 1957; Hostetler, 1936). Results indicate no major differences due to type.

Similar studies have been conducted by Willey et al. (1951) and Stonaker et al. (1952) who compared Comprest and Conventional type cattle. Results are similar to the majority of the work on dairy cattle with no obvious differences.

The work of Orme (1958), in which an extensive study of various live animal measurements was related to the yield of high priced cuts, gives some indications of the effect of conformation on cutability. Although all relationships were quite low; as a group all circumference and all width measurements on the live animal were negatively related with the percent of high-priced cuts. This means that the thickness and fullness measurements stressed so much in the so-called ideal conformation are actually opposed to a high percentage of high priced cuts. Similarly, the more compact, shorter animal is opposed to a high proportion of high-priced cuts. These results are borne out by close examination of the data.

Rib-eye Area. With the great emphasis being placed on loin-eye area in swine programs, it was only natural that the beef researcher and extension worker should begin to stress the importance of rib-eye area of beef cattle.

Our early work had indicated with hogs (Price et al., 1957) that loin eye area was not a good measure of leanness, although our evidence was all indirect. The first direct evidence on the subject was reported by Cole et al. (1960), who found the separable lean in the carcass and rib-eye area were only correlated to the extent of about 0.4. Subsequent studies by the same group of workers have offered additional information indicating about the same correlation. Interestingly enough, rib-eye area is not a very good indicator of separable lean in the 9-10-11 rib cut, even though a part-to-whole relationship exists. Obviously, this means that improvement in leanness based upon rib-eye area would be slow.

Tenderness. Consumer studies have indicated that tenderness is the eating attribute of greatest importance to the meat purchaser. A number of studies have indicated that the heritability of tenderness is high enough that selection for this desirable trait can be achieved. Alsmeyer et al. (1958) of Florida reported a heritability of 51 percent for Brahmans sires, and zero for Shorthorn and cross-bred sires, with an overall heritability of 129 percent. Although the latter figure is unreasonable, data by Kieffer et al. (1958) gave a heritability of 92 percent for a group of Angus cattle. More values are needed for heritability over a wider population, but improvement in tenderness through breeding appears to be possible.

Quality. Under the term quality, I am discussing all the nebulous factors such as marbling, juiciness, flavor, texture and eating qualities, which are more difficult to measure and evaluate, yet probably contribute to eatability. We should be aware of such factors and not ignore their contributions.

Marbling has been extensively used by the grading service as a measure of tenderness, first, and more recently, as an indicator of juiciness. Although the relationship to tenderness is low, as has been pointed out, the association with juiciness is somewhat higher. In view of the double importance of marbling to two important characteristics of palatability, plus the present reverence shown by the grading service, the importance of marbling cannot be presently over-looked.

The other factors included under quality are certainly important and should be constantly kept sight of, otherwise, unforeseen problems could develop. Although measurement can only be accomplished by subjective methods, any evaluation program should make periodic spot checks to see the characteristics making up palatability are not regressing as other traits are being improved.

Lambs

Little is actually known about lamb as the amount of investigation has been limited. Henneman (1942) found the same general pattern in proportion of wholesale cuts as has been observed with beef. Namely, the thinner, longer-legged lambs yielded a higher percentage of leg than the shorter more compact lambs. It was also noted by Hammond (1932) that as lambs grow and fatten that fat percentage increases most, muscle next and bone the least.

King and Bland (1960) and Knight et al. (1960) found no major differences in percentage of high priced cuts in lambs from different breeds or crosses. Thus, the available data on the effect of type or conformation was in agreement with the work on beef cattle.

The eatability of lamb appears to be less closely associated with the quality measures of marbling and fat covering according to a Texas study (Cover et al., 1944). The authors concluded the article by saying, "In view of the contradictory results from different pairs of lambs---, it seems doubtful that fatness influences tenderness in lambs to any marked extent. Using fatness or thinness as an indication of tenderness may be regarded as of doubtful practical value in buying lamb."

The greatly expanded carcass research on lambs may prove helpful, and both researchers and extension workers should watch for clarification of the carcass relationships. It seems likely that the ease of working with lamb carcasses may be helpful, not only from the standpoint of information on relationship within the species, but could be particularly useful in giving information transposable to beef animals.

Livestock Carcass Improvement Programs

Certainly I do not wish to pose as an expert on livestock carcass improvement, but at best it is my hope to make some suggestions for carcass programs and leave the remainder to you and others. Secondly, I wish to point out some short-comings and pitfalls of some measurements that can be avoided.

First, let me consider something about the current programs and their impact on livestock improvement. In doing this I would like to show some data taken from Brinks (1959) summarizing the improvement occurring in the Iowa swine testing station. The data below show the improvement in carcass that has occurred during a relatively short period of time.

	Barrow Cut-out (Carcass Basis)			
Year and Season	Length	Backfat	Lean Cuts	Loin eye
1956 - Spring	29.1	1.64	48.5	3.22
1956 - Fall	28.9	1.61	49.8	3.50
1957 - Spring	29.2	1.60	50.3	3.40
1957 - Fall	29.1	1.51	51.7	3.80
1958 - Spring	29.4	1.51	51.4	3.62
1958 - Fall	29.1	1.50	52.3	3.81
1959 - Spring	29.5	1.50	53.0	3.63
1959 - Fall	29.1	1.48	54.3	3.94

The data show that length did not change even though there was a 6 percent increase in percentage lean cuts. This illustrates again that carcass length has little influence on cut-out. At the end of the first three seasons a decline in backfat thickness had occurred but then it remained relatively constant. Since there was no change in backfat thickness during the last 5 seasons but an increase of 4 percent in lean cut-out, it seems likely that the increase was due to greater leanness. I wish to point out that there was a marked improvement in loin eye size beginning at the 4th season, but no

marked change thereafter. In view of the fact that lean cuts increased during the time that loin eye and backfat remained unchanged, some would question whether the increase was due to greater leanness. However, I again want to emphasize that loin eye size does not appear to be a good index to total muscling. Thus, if backfat and live weight stay the same, any difference in lean cuts would logically be expected to be due to an increase in total leanness. Brinks (1959) further points out that the change in percentage of lean cuts has resulted from an increase in the weights of the ham and loin, with the weight of the shoulder remaining unchanged.

As we examine the data from the Iowa testing station, we can see that improvement in carcass traits has occurred rapidly. Naturally it is doubtful that the same rate of improvement will occur in the next 8 seasons. Nevertheless, the improvement achieved holds forth hope for such programs, not only with swine but also for beef cattle and sheep.

As you can no doubt see from my earlier comments, I am somewhat critical of the inclusion of carcass length in swine improvement programs. Actually, the inclusion of length is not so serious, except for the fact that a really outstanding animal could be ruled completely out on length, whereas a longer but poorer animal could meet specifications. In other words, the major objection is the adoption of minimum standards. Today there is a tremendous pressure upon breed associations to set up minimum standards. We (and I speak not only for myself, but also for Dr. Magee and Dr. Nelson of the Animal Husbandry staff at Michigan State) do not believe that minimum standards are the best ways to achieve improvement, but that an index system using weighted values for all important production and carcass traits will result in the most effective and rapid improvement.

Another fallacy on carcass improvement that has been widely accepted by research workers, extension specialists, breed associations and farmers has been the expression of loin-eye area in terms of square inches per 100 lbs. of live weight or some other similar equivalent. There appear to be two inherent weaknesses in this system. First, and most serious, it penalizes the larger more rapid growing animal. Secondly, it encourages the feeder to limit feeding in order to develop maximum muscular growth, even though feed costs per unit of gain are greater.

In view of the discrimination against the heavier faster growing animals by using the loin eye area per unit of weight, it is suggested that the use of linear regressions to a constant weight or age be used. This would not penalize the faster growing animals, but would make it possible to determine all animals on the same basis. Although the regression lines have not been drawn on this basis, adequate data should be available to do so for beef, lambs and swine. Due to the rather uniform slaughter weights of hogs, the problem may not be as serious here. Nevertheless the 4 month old 200 lb. pig has to compete in loin eye size with the 200 lb. 6 month old pig.

Now to look at the individual species, let me make a few recommendations for carcass improvement.

Hogs

We are probably in the best position on carcass improvement in swine because of the research information available and the experience which has been gained in certification programs. In view of the discussion, I should like to propose that we do away with minimum standards and substitute an index system. Not being a geneticist or a statistician, I should like to suggest that you consult the animal breeding experts and statistician in working out indexes.

From the carcass standpoint, I should like to suggest that a live probe at given weight or age be the major method of improving hogs on the farm. It is possible that swine improvement programs could be carried out on the farm similar to the Dairy Herd Improvement work, where a paid tester would probe the pigs and give a farmer ratings on his animals for selection purposes.

On the carcass testing, an index based on lean cuts, or perhaps even percentage loin and ham would be most useful. The index should include backfat thickness and loin eye area on an age constant basis.

Beef Cattle

The problem of carcass evaluation is much more serious with beef cattle. Any standards of today will probably have many shortcomings and undoubtedly will need revision as more information becomes available. Again, I believe an index is the best method of approaching the problem of beef carcass improvement. I would base such an index on the percentage of trimmed loin and round. Possibly it would be wise to include the rib with these cuts. Standardized close trim should be practiced to remove excess fat from the surface, and similarly, excess fat should be removed from the underside of the loin. Rib-eye area and tenderness could also be used in the index. Tenderness would require extra work but should be worth the extra trouble. Similarly, marbling score probably should be included in the index. The exact division of the various points in such a system would have to be arrived at on the basis of current knowledge, and would need revision as better information became available.

Lambs

Improvement of lamb carcasses offers the same challenges that we find with beef carcasses. In developing an index, more emphasis should be placed upon loin-eye size, in my opinion. The major cut-out data should use closely trimmed leg and loin. Initially it may not be advantageous to include tenderness as available evidence would indicate it may not be a serious problem. Nevertheless usage of tenderness may prove useful and in my opinion should be included until definitely found to be unimportant.

In giving this talk to you, I realize our knowledge is incomplete, and that we cannot always give concrete suggestions. This will mean that we will make mistakes in our initial attempts to develop improvement schemes. However, a program that is partially wrong will be better than no program at all. Although I have been critical of the swine breed associations today, it is doubtful whether we would have the improvement in swine carcasses that has occurred had it not been for their efforts. We should not be afraid to develop a program, but we should not be bound to protect it when we find it is wrong.

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BEEF CATTLE IMPROVEMENT PROGRAMS 1/

I interpret my assignment on this program to do something in the way of laying a foundation to provide a basis for discussion of Beef Cattle Improvement Programs. I will attempt to cover this subject on a somewhat general basis, and perhaps the details and specifics that are indicated will take care of themselves in the discussion. Undoubtedly some rather pertinent items will be considered sketchily or not at all in my presentation. Perhaps you will give attention to them in the discussion that is to follow. Some of the points that I will attempt to bring out will undoubtedly be controversial, but some personal opinions will be thrown in from time to time. Some of these controversial points and opinions should provide focal points for discussion. Agreement on matters of opinion is neither expected nor invited.

The objective of any organized beef cattle improvement program is to provide the education that will result in an increased rate of genetic improvement in all traits that contribute to productive efficiency and carcass desirability of beef cattle. The traits involved in these two categories (efficiency and desirability) are referred to as performance traits. As we are all well aware, the goals of the beef cattle industry are comparable to all other industries--a superior product at less cost. Cost and desirability are the two major factors that largely determine the consumption or use of any product once it is established. Each of us has a function in regard to aiding the beef cattle industry in these objectives. Our functions vary somewhat, and the specific ways that we approach them may differ; but, obviously, we cannot interpret our broad assignment to be other than helping our industry to produce a superior product at reduced costs. Those of us in the research area are charged with the responsibility of obtaining information that the beef cattle industry can use to improve its economic status. You in Extension have the equally important responsibility of interpreting this information and providing an educational program for the industry so as to result in improved breeding practices. Thus, our activities complement each other in providing the industry with the increased knowledge necessary for improvement in productive efficiency and carcass merit.

In considering beef cattle improvement programs, it might be well for us to briefly review where we have been, where we now are, and where we are likely to be going in the immediate and distant future. Obviously, tremendous changes have been made in our beef cattle populations in the last half century. This is particularly true in their ability to reach desirable grades at younger ages and lighter weights and thus yield a carcass that is more acceptable to our present-day trade. The early-day beef cattle improvement programs, under the leadership of our predecessors and perhaps some of the senior members of this group, were built around purebred sire

1/ Summary of remarks presented by Keith E. Gregory, Regional Coordinator, Beef Cattle Research, ARS, USDA, University of Nebraska, Lincoln, Nebr., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

programs. That these programs were effective is attested by our present populations of commercial beef cattle. Our commercial beef cattle populations were improved to the point where further genetic improvement in them would be difficult by the continuation of this program alone. It became obvious that, if additional genetic improvement was to be made in our beef cattle populations, new knowledge must be obtained to guide improved breeding practices--thus, the development of our research programs to obtain this knowledge and the immediate development of your extension programs to disseminate it. To my knowledge there has not been an agricultural program of any nature where research and extension personnel have worked so closely in putting research results to work with the minimum of delay. You folks have crowded us for information, and we think that such is desirable as it helps us to keep our research programs in perspective. Your questions have been a real stimulus to the research. When we consider that these research programs have been underway for only approximately 12-15 years and an organized extension effort, with a few exceptions, 10 years or less, I think that the general interest in these programs is truly remarkable.

Let us now consider the future. The basic organization of any research program on beef cattle breeding is as follows: (1) Determination of traits of economic value and assessment of their relative importance; (2) Development of reliable procedures for measuring and evaluating them; (3) Determination of inbreeding and heterosis effects, the obtaining of estimates of heritabilities and genetic correlations, and the evaluation of the importance of genetic-environmental interactions. This type of information involves all traits that contribute to economic value--performance traits. Additional objectives of our research program are to evaluate selection procedures and breeding systems so as to provide you with information that you can use to aid the industry in the development of the most effective breeding practices for obtaining the maximum rate of genetic improvement in all performance traits. These traits are: fertility, mothering or nursing ability, growth rate, efficiency of growth, longevity, and carcass desirability in beef breeding research. We are of the opinion that the primary function of our research program is to increase knowledge in all of these categories. Thus, regardless of the changes in our industry or changes in other industries that may affect ours, the basic knowledge available could be used to aid in adjusting accordingly. However, I am of the opinion we would be remiss if we did not candidly appraise our programs from the long-term standpoint and plan accordingly. I think this applies to your extension programs as well as to our research programs.

It was indicated to you at the beginning that we would get into the area of opinions before we completed our discussion. It seems to me there is a strong possibility that somewhat the same basic structure of our industry we now see is likely to exist for quite a long time, with the basic segments being composed of purebred breeders, producers, feeders, packers, and retailers. It seems probable that each segment is likely to become more specialized with perhaps larger operational units in the breeding, producing and feeding segments. As we are all well aware, the opportunity for genetic improvement in our beef cattle populations rests primarily with the purebred segment of our industry. The bulls the purebred segment produces determine what the commercial segment can accomplish in the way of genetic improvement. The basis for existence of the purebred segment of our

industry is none other than to serve this function. My statement to the effect that the basic structure of our industry is likely to remain similar to what we now have assumes that this function will be discharged. Does this assumption seem valid to you? I am of the opinion the purebred units of the future are likely to be much larger, on the average, than we see today and certainly much more specialized. In other words, they are likely to represent a primary enterprise, if not the only enterprise, on the units involved. What bearing might this have on beef cattle improvement programs of the future? As we are well aware, purebred beef cattle numbers now have a fairly high representation from smaller herds representing a secondary enterprise on many farms and ranches. Thus, it would seem there is a distinct possibility you will be working with larger, more specialized units that are operated by competent breeders. Another question that seems to bear on the matter is the role our Breed Record Associations are likely to play in this educational program. How might this affect your own educational programs?

As we have indicated, if beef cattle improvement programs are to have a major impact on the rate of genetic improvement in our beef cattle populations, they must in the end involve our seedstock or purebred herds, regardless of what means one uses in getting this accomplished.

It seems your work as educators will probably involve much closer and more thorough counsel with a smaller number of better informed breeders. In addition to providing information on what traits to measure, measurement procedures, the development of systematic recordkeeping programs, and the use of these records, you are likely to be called on to provide counsel for setting up specific breeding programs involving selection methods and procedures (individual performance, pedigree, and progeny test information) and breeding systems and procedures (use of inbreeding and heterosis, outbreeding, assortive mating, etc.). This assumes, of course, that our research programs will be effective in providing you with this information.

It seems we should now get back to where we are today and face some of the questions that are of immediate concern to us. The progress beef cattle improvement programs have made was indicated earlier. However, it seems that much remains to be done in regard to reaching our real seedstock or herd bull herds. This is where the real opportunity for genetic improvement lies, and the procedures for reaching them with your educational program would seem to be a pertinent topic for further discussion. Is satisfactory progress being made in regard to this matter?

An important consideration is the development of adequate procedures for measurement, the development of a systematic records program, and the use of these records for making comparisons between animals within a herd. The main objective is orderly, systematic procedures for making effective comparisons. I am well aware that opposing philosophies exist in regard to the desirability of breeders doing all of the work on their own records versus getting it done on a service basis either through extension programs or commercial firms. One of the advantages given for an individual keeping his own records and working directly with them is that it serves as a real factor in the stimulation of his interests by making him more cognizant of the differences that actually exist among animals within his herd. Certainly,

if a breeder proceeds on this basis, he needs some close counsel in developing adequate procedures and a systematic records program. An advantage that has been given for the central records approach, with somebody else performing this service for the breeder, is that the breeder is so busy with so many other things he will not get it done at all if it is left up to him. Each of you has opinions in regards to this matter; and, certainly, the future structure of our industry does have some bearing on it. The role the Breed Record Associations will play in regard to this matter is also a factor. As I indicated to you, I am of the opinion our purebred herds in the future will probably be more of a primary enterprise on the individual farms and ranches where they are maintained. The real question in this matter seems to be the optimum amounts of service and education. The pertinent question is how much service is necessary in order to accomplish the education. The educational program, or getting the information to breeders, is primary.

Another matter worthy of consideration is that of organizations. What functions can they serve, and how can you use them most effectively? You folks have considered the matter of uniformity of procedures from time to time. The question of uniformity of reporting and of procedures for adjustment of age and sex differences is involved. To be sure, uniformity of nomenclature to facilitate communications seems desirable. Uniformity of procedures that involve application of principles is definitely indicated. However, the details of procedure may vary a great deal in different herds, depending on the specific management programs, etc. For example, adjusted 12-months' weight may be indicated as a measure of growth rate under some management programs while an adjusted 18-months' weight may be desirable in others. I wonder if the matter of uniformity in regard to details of procedure may not be overemphasized. Conformation evaluation or scoring would seem to be one trait for which uniformity would be feasible.

It seems desirable to comment on the matter of absolute standards. For traits concerned with growth rate (pre-weaning and post-weaning), it seems that the expression of each individual's performance relative to herd or group average would be indicated. If the management conditions differ within a herd, this should be relative to his treatment group average. Because of the tremendous variation in environmental conditions, production programs, etc., it seems rather difficult and probably pointless to set standards other than in terms of capabilities for defined environments. The major function of beef cattle is to utilize our land by efficiently converting the feed that can most advantageously be produced on individual farms and ranches into a highly palatable and nutritious product. Average weaning weights of 500 pounds may be realistic in some environments and in some production programs while 350 pounds may be realistic under some adverse conditions. Yet, beef cattle may provide the most desirable procedure for utilizing the land in the latter case. With this tremendous variation in practical production conditions and programs, comparing the absolute records of animals of different herds is of very limited value. Expressing records as a ratio of herd or group averages gives recognition to the superior genotypes within a herd. While there are genetic differences between herds, environmental conditions tend to be much larger. Thus, comparison of records between herds tends to recognize superior environment, and the objective is to recognize superior genotypes. This same situation

applies in the development of recognition programs using standards expressed in absolute units. If recognition programs are a must, they make much more sense if they involve deviations from herd or group averages and are thus necessarily restricted to individual animals within a herd. In the final analysis the genetic merit of different herds tends to be compared through the performance of the bulls they produce in topcross tests. This is a much more satisfactory basis for comparison and is the way reputation herds are built. As a rule, when the commercial producer buys bulls, he is interested primarily in comparing the records of different individuals within a herd rather than in comparing differences among herds. He usually has some knowledge of the performance of bulls from different herds on the basis of his or his neighbor's experience.

Another matter that seems to be worthy of comment is in regard to the use of central testing stations in beef cattle improvement programs. If central testing stations are properly conducted, they do have some merit for providing a basis for comparing genetic differences among herds on some of the economically important traits. However, it seems that central testing stations do have some distinct limitations that should be considered. For a complete discussion of the use and limitations of central testing stations, I would like to refer you to North Central Regional Publication 119, Principles of Record of Performance in Beef Cattle. Most of you already have access to this publication. Perhaps we can profitably spend some time on this matter in the discussion session.

I am aware that I have not put much emphasis on an educational program for commercial producers. Certainly, I feel that the commercial producer must understand the principles of record of performance and the basis for genetic improvement in beef cattle. Perhaps breeding schemes for the utilization of heterosis may be part of such future educational programs, should heterosis prove to have an important effect on performance traits.

One other matter on which I would like to comment at this time concerns the area of certification of records. I, personally, take a rather dim view of this aspect of some of the beef cattle improvement programs. To be sure, a breeder needs help in the development of adequate procedures and a systematic records program. However, I am of the opinion the sooner the breeder can take the initiative on these matters the better off he and your program will be. Certainly, we are all aware that the breeding of beef cattle is very much a reputation business, and faith in a breeder's records is fundamental to his success. The breeder who is not aware of this will probably not be a breeder very long. Honesty is something that cannot be obtained by certification. The certification of weight records has little meaning since there are so many ways to affect them by the alteration of birth dates, etc. Putting maximum emphasis on deviations from herd average and staying away from absolute standards in certification or recognition programs would seem to largely take care of this matter.

There is another matter that I think should be considered in your educational programs. This involves the matter of equitable differences in value. As we are all well aware, there is no substitute for the financial incentive. People will do what they get paid for doing. When we see a

difference in value of $75 in the carcasses of steers of the same weight and quality grade that sold for the same price alive, it seems educational programs are indicated. Such differences in value must be reflected back to the various segments, including the purebred breeder if the necessary incentive is to be provided. Equitable payment on the basis of real value is fundamental to progress in any industry.

I would like to comment in regard to what can be expected from the use of records. As we are well aware, the rate of genetic improvement in beef cattle, at best, is quite slow. However, the results tend to be permanent in nature and accumulate from year to year. Thus, they are transmitted to future generations. Over a period of 15 to 20 years, production in a herd or breed that has been subjected to systematic selection should be noticeably superior to that where such effort is not made.

Your objective in appraising your beef cattle improvement program is to develop ways of making them more effective. I would anticipate the discussion will be centered around this basic theme. I have intentionally stayed away from the carcass aspects because of the previous discussion by Dr. Pearson. It seems the inclusion of specific measures of carcass merit as an important performance trait in your improvement programs is a matter for consideration in your discussions.

I am aware of the fact that we have attempted to cover a great deal of ground in a rather short period of time. As I indicated previously, a detailed discussion of the various aspects did not seem indicated. Many areas we have covered rather sketchily or not at all. Perhaps the discussion of many of these areas that have not been covered is indicated for some of the remainder of the time we have left.

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SWINE IMPROVEMENT PROGRAMS 1/

In spite of the considerable publicity about meaty pork, few people realize the real difference in fat and lean content of extreme types of pigs. Some data on this subject is presented in table 1. Note that in the total carcass, meaty pigs had 30 percent fat while fat pigs had 55 percent. In the closely trimmed ham, the fat content of meaty and fat pigs was 6 and 27 percent, respectively. In all cases, intermediate pigs were intermediate in fat content. These pigs had high energy rations full-fed from weaning weight to market weight of about 200 lbs. Their classification as meaty, intermediate or fat was made on the basis of previous history of line of breeding, physical evidences of fatness, and backfat probe at market weight. The differences could have been even more striking if identification of the pigs when they were classified had been more accurate.

PERCENTAGE OF FAT IN THREE TYPES OF HOG CARCASSES

Type of Hog	Total Carcass	Closely trimmed wholesale cuts		
		Ham	Picnic	Belly
Meaty	30	6	15	41
Intermediate	45	11	22	51
Fat	55	27	38	66

We still do not know a great deal about the characteristics of the pork carcass which consumers prefer, except that there is considerable variation in this respect among consumers. That is, some people prefer cuts of different sizes, differences in amount of fat content, etc. This is fortunate for the industry, since we are not likely to be producing completely standardized and uniform products in the foreseeable future. It is evident that, generally speaking, pigs of the type classified as "fat" in table 1 produce the kind of pork that no one is willing to pay a premium for, and there is relatively little demand for the "intermediate" pork as compared with that produced by the "meaty" pigs.

Carcass quality has an important role in the swine industry, but is by no means the only characteristic which merits attention. We can in no case afford to forget productive characteristics such as growth rate, feed requirements, general soundness and litter size which are the basic components of an efficient industry. Management, nutrition, sanitation and health are fully as important aspects of the overall problems as breeding, although attention will be restricted here to the genetic aspects of improvement programs.

Apparently every livestock industry must go through a period of "trial and error" in developing measurement programs to reflect performance and quality in which many different methods are tried. This was the case with dairy

1/ Presented by L. N. Hazel, Professor of Animal Husbandry, Iowa State University, Ames, Iowa, at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

cattle and poultry when measurement recording systems were first started with those species. Swine and beef cattle are still in this developmental period, and we can anticipate the time when methods and records will be more systematic and standard than they are at the present. The principal methods of systematic performance testing being used with swine now are (1) Production Registry, (2) Meat Certification, (3) On-the-farm testing, and (4) Central Testing.

These methods are intended to accomplish somewhat different purposes, each of which is valuable within itself. The production registry program is important because this represents the first step in the testing program. From a genetic standpoint, it may be expected to have its greatest impact in improving litter size and weaning weight. Since the experimental evidence concerning these characteristics indicate that they are only slightly hereditary, the genetic impact may be expected to be small. However, these characteristics, especially litter size, have great economic importance and can by no means be ignored in a constructive breeding program. Production registry unfortunately has received a black eye in some areas because inadequate supervision of records has permitted a few unscrupulous breeders to take advantage of an otherwise good program. Honest breeders have so resented such an infringement of privilege that many have preferred not to participate in a program that required them to be dishonest or to put their herds in a relatively bad light.

The meat certification program has had tremendous impact, both from an educational standpoint and from the standpoint of the genetic improvement accomplished. While no one would claim that this program is perfect, or that certain sharp practices cannot be employed to make stock appear to advantage, it is about as honest and rigid a program as can be applied over a large area with many relatively small herds which send their pigs to different packing plants. Meat certification is best regarded as a mass screening program in which a large number of sires can be evaluated somewhat roughly. It is sufficiently accurate to eliminate the truly unworthy sires, and to provide some discrimination between the good ones and the very best ones.

Central testing stations should represent the final hurdle set up for recognition of superior sires. Such a small percentage of our total breeding stock can be tested at central stations that the principal impact of the stations must be through education and recognition of the truly superior animals. There is some needless controversy concerning the relative merits of testing boars and barrows. This controversy centers largely around three points. As a progeny test, the testing of barrows provides a more accurate measure of the overall value of a sire because growth rate, feed requirements and carcass data can be obtained on the entire entry. With boar testing programs, carcass data may be obtained on only one or two members of an entry.

The testing of boars has some advantages over barrow testing from the standpoint of immediate genetic impact. Boar testing is more nearly a performance test of the individual boar, and is more direct because the breeding animal himself is tested directly. The sales of tested boars have provided a focal point of interest for those interested in swine improvement which has had

considerable educational value. Central testing is so expensive that barrow testing programs must be subsidized, while boar testing programs have managed to pay their own way fairly well. Spread of disease is a constant hazard with boar testing programs. Health standards for entrance, constant inspection, and extreme sanitation must be practiced to minimize these hazards.

Our experience with on-the-farm testing has been quite gratifying in that participating farmers have had striking success in improving performance and quality. But the experience has been disappointing because relatively few herds remain on the program for a long period. We have hesitated to commit extension personnel to programs which involve the weighing of pigs and processing of records because the continuing nature of the work prevents their undertaking other programs. As a consequence, local testing organizations have generally appeared to thrive for a year or two. but eventually to lose membership and disband. Almost always, a successful local testing organization is the result of the interest and initiative of one or two men. When they leave the community, or their interest is directed toward other projects, the swine testing work suffers. Another reason for lack of continuing interest is that after two or three years in a testing program, many breeders make sufficient improvement to eliminate the very worst animals and feel that they can maintain the improvement already achieved by careful boar selection and less intense methods of testing.

Probing pigs has generally given good results under experimental conditions and at the testing stations. I am less confident in the reliability of probes taken under farm conditions, particularly where the sale of breeding stock may be based in part on the probe measurements. The following precautions should generally be taken to make the probe measurement truly reflect carcass quality:

1. The probing should be done by an experienced man who is not directly interested in the pigs.
2. The measurements should be taken at about 200 lbs.
3. The pigs should have been full-fed a high energy diet from birth to market weight.
4. Reliance should not be placed on probes of boars after they have ranted.

Many commercial producers are interested in breed improvement but feel that they cannot devote the time or effort to record keeping that is required by a full farm-testing program. A program which gives 80 to 85 percent of the same genetic impact but is relatively simple can be developed by ear-marking the gilts in the good litters at two to three weeks of age. Those born during one week can be marked at one place on the ear, those born a week later can be marked at a slightly different place, etc., in order to give some measure of age. Final selection of replacement gilts can be made when they weigh around 200 lbs., culling out those that are poor in weight for age, are unsound, or appear overfat. If fatness is a serious problem, probing the candidates for the breeding herd will be worthwhile. The second stage in this program is the emphasis upon use of a well-bred boar. Commercial hog producers are beginning to ask that boars should have performance standards of about 1.75 lbs. of gain per day, feed requirements less than 300 lbs., backfat probe of about 1.1 to 1.2 inches, with some evidence of adequate carcass data on their immediate relatives.

Like most students of livestock judging, I learned to prefer pigs with adequate body length. Now that we are getting more complete data on the subject, it is evident that length has been much overemphasized, especially as an indicator of meatiness. Table 2 shows the average performance of a number of pigs which were full fed a high energy ration in concrete pens from weaning to a slaughter weight of about 200 pounds. Two pigs per litter were fed. The data were sorted according to the average length of body of the two pigs in each litter. Except for the extremely short pigs, there was almost no change in percent primal cuts between 28.5 and 30.9 inches.

Table 2. Average primal cuts, growth rate, and feed requirements for pigs of various lengths.

Length of body (inches)	No. of litters	Primal cuts (percent live weight)	Weight at 5 months of age	Feed per 100 lbs. of gain
Under 28.5	9	43.7	221	338
28.5 - 29.4	31	46.2	221	317
29.5 - 29.9	34	46.8	225	327
30.0 - 30.4	25	46.3	217	329
30.5 - 30.9	20	46.8	225	324
Over - 31.0	23	47.2	220	335

Quite clearly, weight at five months of age is not associated with length of body. As regards feed requirements, the very shortest and the very longest pigs had slightly higher requirements, but this is probably purely accidental.

The same data were sorted according to percent primal cuts. In table 3, there is a slight but definite trend toward slower growth rate in the meatier pigs, but this does not seem to be associated with feed requirements at all. This slightly antagonistic relationship between growth rate and meatiness is not serious if it is recognized and a definite effort made to select meaty breeding stock with good growth characteristics. It could be serious if it were to be ignored completely because the development of meaty but slow-growing types of pigs could bring discredit upon what is otherwise a good improvement program.

Table 3. Average growth rate and feed requirements for pigs grouped according to percent primal cuts.

Percent cuts (percent live weight)	No. of litters	Weight at five months of age	Feed per 100 lbs. of gain
Under - 43.0	9	219	326
44.0 - 44.9	19	222	330
45.0 - 45.9	23	220	328
46.0 - 46.9	32	224	322
47.0 - 47.9	36	227	327
48.0 - 48.9	13	214	331
Over - 49.0	11	212	328

There is a rather common belief that pigs grown on pasture are considerably meatier than those grown on concrete. Experimental evidence bears this out only to a very, very slight extent. The data in table 4 were taken on litter mates, one of which was grown on concrete and one on pasture. Six litters of each type were used in the experiment. Classification as to type was made at the beginning of the experiment, according to the previous knowledge and performance concerning the lines of breeding. In all cases, the pigs were full fed a high energy ration. Feed requirements were approximately the same, but the pigs on concrete grew somewhat faster and went to market about 10 days earlier than those on pasture. Note that the big difference in percent lean cuts is associated with line of breeding and not with method of rearing.

Table 4. Percent lean and fat cuts for fat and meat breeds grown in concrete pens and on pasture.

	Concrete Lot		Pasture	
	Lean cuts	Fat Cut	Lean Cuts	Fat Cuts
Breeding	%	%	%	%
Fat x Fat	40.4	22.9	39.6	23.5
Meat x Meat	46.6	16.2	48.1	15.8
Fat x Meat	45.7	19.1	46.4	17.5

More attention needs to be directed toward practical and labor saving methods of restricting feed consumption, because this can result in definite carcass improvement as well as in some saving of feed.

Figure 1 shows the correlation coefficients we obtained between backfat probes at several different positions and percent fat cuts. This was the result of one of our early efforts to identify the positions which were the most accurate sites for probing. Perhaps a mistake has been made in adopting as standard the three positions behind the shoulder, at the middle of the back, and over the loin. Our early work probing at the midline of the body gave consistently poorer results than probing over the longissimus dorsi. Neither were efforts to probe the side of the ham and the side of the shoulder sufficiently promising to be given further attention. However, I doubt that we were so fortunate as to pick the three most accurate sites during our very early attempts, and the matter could very well receive further investigation.

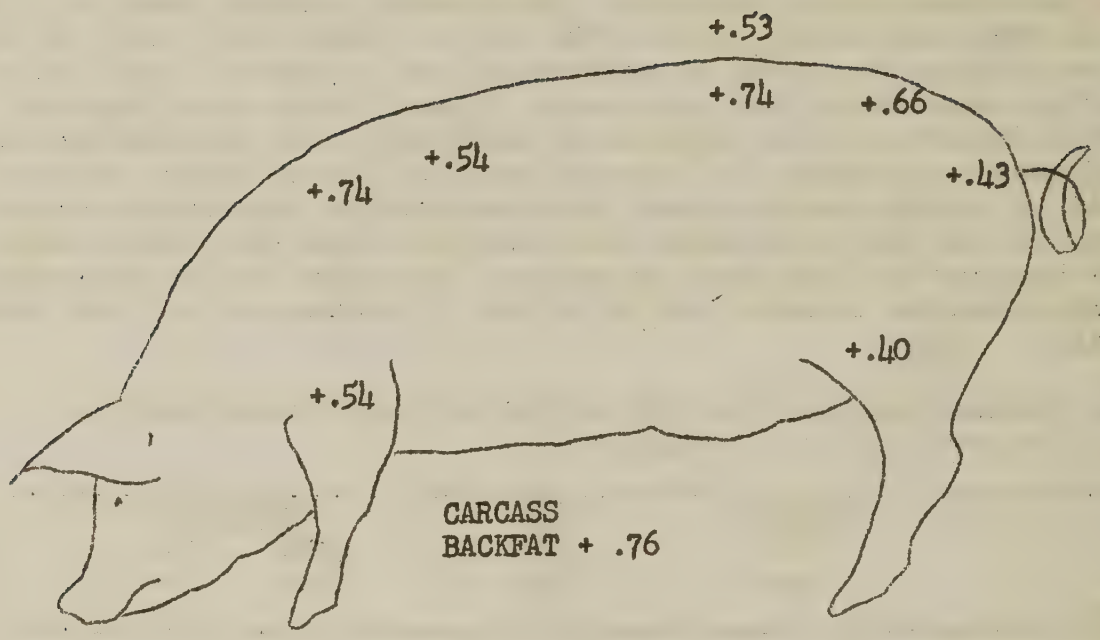

Figure 1. Correlations between percent fat cuts and backfat probes at each of eight sites.

As swine technology improves, the inherent productiveness of the pigs also becomes of increasing importance, lest that become the limiting factor which provides the ceiling for efficient production. For this reason, the ability to convert feed efficiently into pork is likely to receive increasing attention in the future. Table 5 shows some computations concerning the net value expected to accrue to swine enterprises by improving feed requirements and litter size. Note that when pigs raised per litter is relatively low, this factor is about 4 times as important as the given increase in efficiency of gain. As the number of pigs raised per litter increases to 9, an additional increase in litter size is actually worth less than improving efficiency of gain by 1/10 of a lb. of feed per pound of gain. For these reasons, feed efficiency is likely to become more important and merit increased emphasis in breed improvement programs as other items of productivity improves.

Table 5. Relative economic values for efficiency of gain and litter size in hogs.

(Computed as pounds of feed saved per hog sold)

Number of pigs raised per litter	Efficiency of gain	Litter size	Ratio
	units of $\frac{1}{10}$ lb.	units of 1 pig raised	
4	16	65	4.06
5	16	43	2.69
6	16	31	1.94
7	16	23	1.44
8	16	18	1.12
9	16	14	0.89

Feed requirements:
Per sow for 6 months = 1300 lbs.
Per pig from birth to weaning = 50 lbs.
Per pig from weaning to 200 lbs. = 640 lbs.

Tables 6 and 7 show heritability estimates for items of conformation and performance characters in swine. Note that the items of conformation generally are considerably more highly hereditary than those dealing with performance. Perhaps the relative ease of changing conformation by selection, as compared with the difficulty of measuring performance and the lack of apparent response in performance, has contributed to lack of attention by breeders to the performance characters.

Table 6. Heritability estimates for items of conformation in swine.

	Heritability %	
	Range	Approx. Av.
Length of body	40 - 81	61
Length of legs	51 - 75	64
Number of vertebrae	---	--
Scores of conformation	20 - 33	26
Type:		
Within a type	---	38
Between types	---	92

Table 7. Heritability estimates for performance characters in swine.

	Heritability %	
	Range	Approx. Av.
Number of pigs farrowed	3 - 24	15
Number of pigs weaned	3 - 32	19
Weight of litter at weaning	7 - 37	17
Weight of pigs at approx. 5 months	18 - 26	21
Growth rate (Wn. to 180-200 lbs.)	22 - 46	30
Economy of gain	26 - 57	38

Genetic improvement will be more strongly directed toward the performance characters in the future because their economic importance is now recognized and less attention will be paid to items of conformation as it becomes evident that meaty, productive pigs can be developed within a wide range of types.

Breed differences are always a difficult and controversial subject for swine specialists. I would like to make several points in this regard. First, breeds do differ from the standpoint of averages, some being better in litter size, others better in growth rate or meatiness, etc. Second, there is considerable variation between individual animals in the various breeds. Our breeding methods are simply not powerful enough, even if it were desirable, to produce completely uniform animals within a breed. Third, even

where we have been able to measure breed differences in localized groups of our swine population, differences in breeders goals and the emphasis they put on different characteristics immediately tend to make the results obsolete.

Most of the experimental work comparing purebred and crossbred pigs has tended to show about an 8 to 10 percent advantage in livability and growth rate for crossbred pigs, as compared with purebred pigs. There are also comparable advantages in mothering ability and litter size for crossbred sows as compared with purebred sows. This is demonstrated in a practical way by the widespread practice of crossbreeding for commercial production. Our own experiments do not show any tendency for rotational crossbreeding programs to deteriorate or "run out" in successive generations, so long as well bred boars from productive breeding stock is used.

We perhaps have missed an opportunity in the past in not emphasizing sufficiently to farmers and commercial producers the advantage of using good boars for commercial pig production, even when their progeny were to be crossbred. The exact number of breeds to use in the crossing program and the specific breeds to use may not be so important as such questions of availability of satisfactory stock, kind of production program employed, and market outlets available.

Table 8 shows the difference accumulated through four generations of selecting for high and low probes in the Beltsville Duroc line. Note the very considerable difference in backfat and the accompanying changes in percent lean cuts and loin eye area. This experiment provides a striking example of what can be accomplished by consistent and accurate selection.

Table 8. Results in four generations of selection for backfat probe in the Beltsville Duroc line.

	High Backfat Line	Low Backfat Line	Control Line
Backfat in inches	1.82	1.25	1.57
Daily gain in pounds	1.47	1.58	1.58
Lean cuts percent	36.8	40.9	38.6
Loin eye area	3.06	4.16	3.49

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IMPROVEMENT PROGRAMS FOR SHEEP 1/

The need for sheep improvement is probably greater now than ever before. We might first review the present status of the sheep industry. The sheep industry is small as it produces only about 2 percent of the income from livestock and only a little over one percent of the total farm income in the United States. However, the potential is high. We consume about 4 pounds of lamb and 3 pounds of wool per capita which are only slightly above the world average. Of course many people eat no lamb at all. If the sheep industry were doubled we would still consume far less lamb than many other countries and far less than other kinds of meat. If we doubled our wool production we would be about self-sufficient in wool production but doubling the numbers of sheep would reduce the surplus of feed crops by about 10 percent.

Sheep numbers declined from about 50 million head at the beginning of World War II to about 26 million at the end of the war. We now have over 30 million sheep, but the number is probably on the decrease.

Lamb productivity per sheep has increased since the war. This increase has been brought about by higher lambing rates, lower death losses and heavier slaughter weights. Lamb prices, relative to beef prices, have declined since 1957. Present lamb prices are discouragingly low and the outlook for improvement is not good. The sheep industry can probably not survive anywhere near its present level unless higher prices or marked increases in efficiency of production are obtained. Increased efficiency will probably result from present trends to more intensive and thus more specialized production. To facilitate more intensive production, we will probably need more than one lamb crop per year, a higher lambing rate, earlier weaning, faster gains, and heavier feeding of concentrates, particularly creep feeding.

How can improvement be achieved? Animal breeders have been accused of overemphasizing the importance of breeding. Actually I think management, marketing and feeding improvements will be more important than breeding in producing immediate and quick gains in efficiency of production. But breeding and improvement of breeding stock form the base upon which these management and other efforts must build. For example, we know that open-face ewes produce more lambs and more pounds of lamb per ewe than do ewes with covered faces. Nevertheless, probably over half of the sheep in the United States have covered faces. These covered faces can be eliminated by selection and breeding and thus increase the efficiency of lamb production.

There are two main avenues for gains through breeding. First through crossing of breeds we know that we can increase lamb production, livability of lambs, rate of gain, and pounds of wool over the average of the parent breeds.

1/ Presented by Clair E. Terrill, Chief, Sheep and Fur Animal Research Branch, Animal Husbandry Research Division, Agricultural Research Service, Beltsville, Md., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebraska, May 23-25, 1961.

To be successful, highly productive breeds are needed with which to make the crosses and a definite system of crossing based on research results should be followed. The second avenue of improvement involves selection within breeds. Improvement of sheep through selection is probably the most important way in which permanent productivity of sheep can be increased.

Two kinds of progress result from selection. Permanent genetic progress comes mainly from the selection of rams while much of the apparent gain from selection of ewes results from the changing of flock composition. In other words, the lower producing ewes are eliminated from the flock, and thus the average production of those remaining is higher. Some genetic gain results from this kind of selection but it is not nearly as important in making genetic changes as that which is obtained from the selection of rams. The difference is explained by the much lower proportion of rams than of ewes which need to be used in breeding.

Certain aids to selection are important. Identification of individual sheep through ear tagging and the keeping of individual production records forms the basis for any selection program. Records should be taken under uniform conditions. Central stations for performance testing help provide these. Certainly records made on one farm cannot be directly compared with those made on another. Even under uniform conditions certain environmental effects must be recognized and adjustments must be made. For example, difference in age at weaning will account for about a half a pound per day in weaning weight. We know that type of birth has important effects on weaning weight and other weanling traits. For example, twin Columbia lambs may weigh from 14 to 16 pounds less at weaning than single ones, while twins raised as singles may weigh from 6 to 7 pounds less than lambs born as singles. Age of dam also is important. Lambs from 2 year-old dams may weigh from 7 to 11 pounds less at weaning than lambs from mature dams. Of course, ram lambs generally average about 10 percent heavier than ewe lambs.

The use of selection indexes facilitates and simplifies the use of production records in selection. No matter how one selects it is necessary to use some kind of a collective judgment on the over-all value of each individual in order to rank the individuals. A calculated index provides a consistent and most nearly correct emphasis on the most important traits. Furthermore, an index tends to set standards of selection and after one has been used for a while the most valuable and most highly heritable traits tend to receive more emphasis even when the index is no longer calculated. Selection indexes have an advantage over independent culling levels by permitting high excellence in one trait to overbalance or counteract weakness in another trait so that the animal selected has the best average over-all merit.

Economically valuable traits must be emphasized in selection. About two-thirds of the income from sheep comes from the sale of lambs for meat and, therefore, pounds of lamb should receive greatest emphasis. Traits which are important in affecting pounds of lamb produced include livability or low lamb mortality, high rate of gain, and heavy weaning weights. However, probably of greater importance than these are fertility and twinning rate. These are difficult to select for directly, but related traits such as open face or body size are very important and can be used. For example, open face

ewes produce more lambs and more pounds of lamb. Large, heavy ewes also wean more pounds of lamb per ewe. The rate of twinning is lowly heritable, but it still probably pays in selection to favor twin lambs from young ewes.

Although pounds of lamb may be closely related to income we still must not overlook quality of the product produced. The best measure of lamb quality is probably the cut-out value of the carcass. Of course, we are interested in a high lean content of the carcass with sufficient fat cover for handling and storage. However, we cannot select very effectively for these until we have better measures of them in the live lambs. Conformation and condition should receive minor emphasis in selection until we do develop more objective measures of lamb quality.

Pounds of wool or fleece weight should receive emphasis in selection because about one-third of the income from sheep comes from the sale of wool. Heavy clean weight is probably most important, and the squeeze machine developed by Prof. Neale of New Mexico provides a quick and easy way of estimating clean fleece weight although its use may not be feasible in small flocks. Of course, quality of wool should not be overlooked, particularly long staple and high density.

It not only is important to emphasize the economically valuable traits, but we should also emphasize the highly heritable traits because more rapid progress can be made in improving these through selection. Traits with moderately high heritability include weaning weight, open face, staple length, and fleece weight.

Performance testing is a valuable aid to selection as it focuses attention on production traits. It also provides more uniform conditions under which records are taken and used, thus making them more valuable in selection. On-the-farm performance testing is probably best for the larger breeders, particularly those who have flocks closed to outside breeding. The ranking of animals within a flock on production traits is essential for any system of selection, and, therefore, on-the-farm performance testing should be encouraged wherever possible.

Central testing stations are particularly advantageous for small breeders, and they do permit the comparisons of breeding animals among breeders. Central testing stations can provide guides for breeders much in the same way as livestock shows are intended to do. Central testing stations have an added advantage in making feasible certain measures, such as feed required per pound of gain, or clean fleece weights which might be difficult to obtain in small flocks.

Progeny testing is generally carried on along with performance testing and provides a more accurate measure of the breeding value of sires. However, progeny testing is generally not useful for traits which can be measured in both sexes. This is true for most of the important traits of sheep. In this species the increased accuracy by use of progeny testing is generally offset by the slower turnover of generations. However, progeny testing does have the advantage of permitting a breeder to compare his own sires with those of other breeders. Its use is almost essential for selection on

carcass traits. It sometimes reveals recessive defects, and it seems essential if the selected sires are to be used on large numbers of females, as with artificial insemination. Progeny tests should always be evaluated on the unselected offspring of the sire. It may even be desirable to evaluate the progeny tests on an index basis, largely on the lowly heritable traits. In this sort of system, the initial selections for rams to be tested should be based on highly heritable traits, and then the lowly heritable traits should be emphasized when selecting the sires on the basis of their progeny.

Artificial insemination is important from a selection standpoint because of the tremendous increase in the sire selection differential which is made possible. However, artificial insemination has not been used except in an experimental way in the United States. The chief difficulties which limit its use are first, the lack of success in freezing and storing of ram semen, and second, the large amount of labor required in detecting ewes in heat. Efforts to control estrus and ovulation through injection or feeding of progesterone give promise of helping with the second problem. If ways could be developed to store ram semen more successfully it is probable that artificial insemination of sheep would become more common in this country.

Although accurate records on individual animals constitute the basis of selection, there are a number of other factors which are important in increasing the rate of genetic improvement. The first is to emphasize the selection of rams. About 80 to 90 percent of the gain from selection of sheep comes from the selection of rams. Therefore, much more attention should be given to this than to the culling of ewes. It is important to postpone any ram selection until the first objective records are obtained which is usually at weaning time. However, yearling records are probably best because many temporary environmental effects have leveled off by this time. In producing rams for use in breeding it is always important to produce an excess of rams to select from, as the selection among the rams themselves is usually more effective than any which was practiced among their parents.

Ram generations should be turned over rapidly. This can be done by using only yearling rams in breeding. If progress is being made with selection, the best son should always be better than his sire, although this is probably only true if a relatively large number of sons are being produced. Thus it is best to change to the best son of an outstanding sire as quickly as possible.

Performance and progeny testing can generally be combined to advantage at central testing stations. Such stations should provide services over and above those feasible with on-farm testing.

In larger flocks, it pays to select the best individuals to go into a closed super-flock in which the best sires are mated to the best ewes to produce the replacement breeding animals for the remainder of the flock. This kind of breeding system is generally followed in the larger stud flocks of Australia and is being practiced to some extent in this country. One particular example is the Redd Ranches' flock at La Sal, Utah, where the Colorado and Utah Station and the U. S. Department of Agriculture are

cooperating in a project to demonstrate the effectiveness of a selective breeding system.

Performance testing is desirable because:

1. It permits objective comparisons among breeding animals.

2. It provides objective comparisons among breeders.

3. It sets standards for relative emphasis on various production traits.

4. It serves as a stimulus for improvement of livestock and sheep.

5. It results in improvement in important production traits.

Performance testing programs which have been underway for a number of years in the United States have demonstrated that they do lead to improvement. For example, in the Sonora, Texas, Ram Trial, improvement has been shown in all traits except face covering. In the Wisconsin Farm Testing Program, increases have been shown in percent of twins, lamb weight, and pounds of lamb per ewe, although slight decreases were shown in fleece weight. It is also generally true that performance testing programs are accompanied by improvements in management and other production practices.

Effectiveness of performance and progeny testing can be increased by:

1. Emphasizing individual record keeping and on-farm testing in those flocks producing rams for sale.

2. Emphasizing selection based on traits most closely related to income from market lambs and wool.

3. Maintaining a few central testing stations to set standards and to permit comparisons among breeders and farms.

4. Combining performance and progeny tests at a central station.

In an ideal testing program, rams born within certain dates would be entered after weaning. At this time they would be weighed, sheared, and mated to a random sample of 6 to 10 ewes. At 8 to 10 months, records would be completed on the ram including rate and efficiency of gain and clean fleece weight. Weanling records on the progeny would be taken at about the same time including staple length, fleece weight, body weight, and cut-out value of the carcass. All records would be adjusted for important measurable environmental effects and combined into an index.

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RESEARCH PROGRAM AT THE FORT ROBINSON BEEF CATTLE RESEARCH STATION 1/

The research program at the Fort Robinson Beef Cattle Research Station involves studies on beef cattle breeding, physiology of reproduction, and nutrition and management.

The research in beef cattle breeding involves a selection experiment and a crossbreeding experiment. The selection experiment involves three 150-cow, 6-sire lines. The selection criteria in these lines are weaning weight in one line, weight at 18 months in the second line, and a combination weight and conformation score at 18 months in the third line. Two bulls will be selected from each line in each year, and each bull will be used for a total of three years. All performance traits will be measured in these lines even though the selection criteria will be only for the traits indicated. The male calves out of three-year-old heifers will be castrated and individually fed to obtain information on feed efficiency and carcass characteristics. All of these lines will be closed to outside breeding. It is anticipated that this experiment will run for at least 20 years. The objectives of this experiment are to determine the effectiveness of selection for the traits indicated and to measure the correlated response in all other traits.

The crossbreeding experiment involves the Angus, Hereford, and Shorthorn breeds. The basic objectives of this experiment are to determine the influence of heterosis on growth and carcass characteristics and on fertility and mothering ability. The experiment is designed so that straightbreds of each breed and reciprocal crosses among the three breeds are produced in each season. The straightbred and first cross steer calves are fed out to determine the influence of heterosis on growth and carcass characteristics. Straightbred and crossbred females will be retained to measure the influence of heterosis or hybrid vigor on fertility and mothering ability. The basic comparisons in this experiment are the crossbreds with the average of the straightbreds used in the cross to measure heterosis or hybrid vigor effects. It is planned to produce three or four calf crops from the straightbred cows. The straightbred and crossbred females will be retained to produce three to five calf crops to determine the influence of heterosis on fertility and mothering ability.

The research on physiology of reproduction has as a basic objective, the determination of the factors that influence percent calf crop. This involves genetic and nutrition-management studies. Studies are underway regarding calving difficulty, interval from calving to first estrus, embryonic mortality, and bull fertility. Studies on the control of estrus have also been conducted, and more are being planned. Nutrition-management studies have been conducted on the effect of energy level on interval from calving to first estrus and conception rate in mature cows.

1/ Summary of remarks presented by Keith E. Gregory, Regional Coordinator, Beef Cattle Research, ARS, USDA, University of Nebraska, Lincoln, Nebr., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

Nutrition and management studies have been conducted on supplemental winter feeding of calves grazing on native range and fattening trials with yearling steers and heifers. The studies with calves grazing on winter range have involved level, source, and feeding interval of protein supplements. The fattening trials have involved hormone implant studies and different levels of beet pulp in fattening rations.

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REGIONAL EFFORTS 1/

The word Cooperative characterizes the concept and spirit of Extension. The strength and efficiency of the Cooperative Extension Service is dependent upon the manner in which its members fit into the organization and work together for a common purpose. The cooperative relationships involved in the total extension effort are too numerous to mention. I have been asked to discuss an area of cooperation which apparently has received little attention on the part of speakers and writers. It is the subject of Regional Efforts.

To begin with, a definition of "regional" seems in order. "Regional" as commonly understood embraces a geographic area larger than one State. It means that those States or parts of States which are included in the so-called region are tied together administratively or have similar conditions which logically places them in the same zone or category. For the purposes of this discussion, reference to "region" will denote the North Central Region -- a mutual grouping of States for extension administrative purposes. Reference to "area" will mean groups of States or parts of States within the region.

Why are we concerned with regional efforts? What is happening in the livestock industry to prompt the workshop planning committee to schedule this subject as a major topic for discussion? It is the growing awareness that many extension programs can no longer be self-contained within traditional political divisions.

County lines were established in the horse and buggy days when the court house and trade centers had to be located close to the people. With the advent of motor transportation, the economic and social nerve centers have been shifting to larger trade areas which go beyond county and even State lines. It has given rise to the area approach to problem solving as economic entities are not necessarily restricted by political boundaries. New dimensions in relationships have developed in the problem solving process as a result of this broader concept. In many instances these relationships are regional and nationwide in scope.

A typical example is the Meat-Type Hog Program. The hog farmer has had to remodel his pork production program because of changed eating habits of consumers in distant population centers and because of economic pressures beyond his control. The chain of events from the suckling pig to the ready-to-serve ham on the retailer's counter involves many different interests -- each with a vital contribution to make and each working for his share of the consumer's pork dollar. Thus, the producer's problem is not something set apart from the rest of the industry. Problems arising in any one of the links in this chain are of direct concern to every

1/ Presented by Charles E. Bell, Jr., Chief, Animal Industry Branch, Federal Extension Service, U. S. Department of Agriculture, Washington 25, D. C., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

other link. The production of meaty lean hogs can be achieved only through cooperation and coordination of all segments of the industry. It requires a desire on the part of everyone concerned to help bring this about and a willingness to make such adjustments as are necessary in their own operations.

Extension has the key role of educational leadership in this industry-wide program. In following through with an effective meat type hog educational program, it is essential that extension coordinate its efforts with all segments of the industry. It is equally important that there be close cooperation among the State specialists in this joint effort.

In keeping with my assignment, I would like to suggest some of the benefits which could result from regional or area efforts.

1. Exchange of Ideas Among Specialists From the Participating States

This could be the most important benefit accruing from regional cooperation. It is easy to become so busy trying to keep up with overwhelming demands on our time, that we fail to realize that many of our techniques have become threadbare. Then something happens which jolts us into the realization that a fresh approach is needed. When faced with this situation, the busy specialist sometimes feels frustrated and inadequate. He is either groping for new ideas which have worked in other States or perhaps he has hit on an innovation that others could well use. When working with specialists from other States in a regional effort, the opportunity for exchange of ideas is developed to its fullest extent.

In my travels around the country, I have a chance to observe extension work in action under many different situations. I am impressed with the ingenuity and originality which is revealed from time to time by specialists in devising more effective ways of getting a job done. At times I am also surprised that the technique has not been shared with their counterparts in other States. It is an example of "hiding our light under a bushel." If each specialist who comes up with a good idea would assume the initiative in sharing his experience with his counterparts, I feel sure that he will feel repaid many times by the ideas that flow back to him from others.

2. Helps us tell the same story

Livestock producers have many sources of information available to them today. They are becoming increasingly confused by the contradictory information which often comes from these varied sources and across State lines. If Extension is to maintain its reputation for making sound and unbiased recommendations, it is extremely important that we tell the same story. We have the difficult job of guarding against going overboard on new untried innovations on the one hand and impeding progress by being too conservative on the order.

It seems to me that here is an excellent opportunity for close liaison and cooperation between specialists in States with similar conditions.

Looking back on my own experience as a State specialist I recall a confused situation which existed because of contradictory recommendations coming from our own Extension Service as opposed to those of an adjoining State concerning a specific field crop practice. We had a number of counties that bordered on this particular State. Their conditions were similar to those across the State line. Since the other State college was located much closer to these counties than our own, the farmers looked to it for information. This created a very embarrassing situation for our own county agents in this area as they were disseminating recommendations from our own institution and the farmers were following instructions from the other State.

I have observed similar confusion over the country in counties bordering on other States that have adopted different standards for grading beef bulls. Many other examples could be cited. When one notes the number of land-grant institutions that are not centrally located in their States, we realize how easily this situation could arise. Furthermore, in the average State, at least one-third of the counties border on an adjoining State. Nebraska, for example, has 39 border counties out of a total of 93. We must keep in mind that internal policies and methods are the perogative of the people within the States as it should be in our democratic society. However, there are some program areas where more interstate coordination would strengthen Extension's effectiveness. By this means, we would not confuse the public and leave a question in their minds as to who was right or wrong or whether anyone knows what he is talking about.

3. Reduce time wasted in duplicating efforts

"I have more time than money," is a popular phrase that does not usually apply to the extension worker even though we may be underpaid. Time is probably the most precious resource the specialist has for he never seems to have enough of this commodity to meet all of the demands for his services. The employment of additional specialists on a State staff does not reduce the pressure on the individual specialist's time to the degree one would expect. It is true that larger staffs can handle more and broader programs. In actual practice, each specialist finds himself just as busy as ever. This means that the answer to the problem is to make best use of the time we have and avoid duplication of effort wherever possible.

It appears to me that the possibility of reducing duplication of effort through regional or area cooperation is worth exploring. This may be especially true in the preparation of certain types of subject matter material that are adapted to more than one State. A number of excellent regional publications have been prepared by various regional committees or study groups in the North Central Region. The New England States have prepared several livestock subject matter bulletins on a regional basis. Conditions in that group of States are sufficiently similar to warrant the adoption of uniform publications for use throughout the area. They were written by a committee composed of one livestock specialist from each State. Experience with this system has revealed some disadvantages. Differences of opinion among the committee, as

well as communication difficulties, caused undue delays in completion of the manuscripts. Furthermore, some of the States were not satisfied with the compromises that were necessary to complete the task. In spite of this, the technique merits further consideration.

Another approach is by reproducing material developed in another State, with revisions to adopt it to local conditions. This is a practical way to reduce duplicated effort, especially in the case of material which is needed in smaller quantity within any given State.

4. Make best use of talents and resources

This point is closely related to the previous one. In fact, time, talents and finances are all essential elements in conducting any extension program. States vary greatly as to the extent that these resources are available to them. Some State extension services receive more financial support than others and are able to employ larger staffs. Likewise, individual specialists differ as to their experience, training and areas of greatest proficiency. For example, one State specialist may be tops in swine management, another in swine breeding, still another in the nutrition aspects, etc. Each with outstanding ability in a given field with something he can contribute to a total program. It seems to me that cooperative efforts on a regional or area basis offer a splendid opportunity to make greater use of these talents for the benefit of all concerned. In this way there is a mutual sharing of the best thinking that each State has to offer.

This principle is equally applicable to the efficient use of physical resources. An excellent example of this in our field of interest is the central processing of herd performance records. The dairy boys have shown the way in processing DHIA records. They have established central processing centers stratetically located to service groups of States. We are rapidly approaching the stage in our beef cattle and swine improvement programs where we need to convert to electronic processing of herd data. Electronic computing units are costly and personnel trained in this field are not available in every State. Furthermore, very few States have a sufficient volume of herd records to justify the expense of operating a processing center. Regional cooperation in this area appears to offer the best answer to a problem which is certain to become more and more acute as livestock performance programs continue to expand.

5. Promotes the team approach

Our agriculture today has more and bigger dimensions than most of us realize. Livestock production continues to become more complex and highly specialized. The wrong recommendations or failure to observe all of the essential elements of management under intensified systems can spell disaster for the producer. This means that Extension must consider the economic soundness and all interrelated factors relating to a new practice when preparing information for dissemination to producers. In order to be of greatest help to the producer in making decisions, the material should include the alternative systems or

practices that are available to him. This calls for teamwork involving several subject matter disciplines. It means that Extension can no longer expect to meet the needs of the people we serve through "lone-wolf" programs.

Examples of this are the excellent publications on intensified swine production systems prepared by means of teamwork in Indiana and South Dakota. Extension animal husbandmen, engineers, economists and veterinarians were involved in this type of effort. I believe this principle could well be applied to regional efforts. There would be some difficulties to overcome, but I am confident that a way could be devised to develop teamwork in appropriate projects on an area or regional basis. Certainly this idea merits further study as the benefits to the States involved could be far-reaching.

The Regional Cooperative Building Plan Exchange is another example of teamwork among the several land-grant institutions in the North Central region in a common effort which is helpful to all States.

6. Some programs are dependent on interstate cooperation

The brucellosis eradication program is a good example of this. Each State could erect a wall around its borders in an attempt to bar outside sources of infection. However, this is a "make-shift" arrangement at best requiring continued vigilance without complete insurance of protection.

The constant interstate movement of livestock and differences in State animal health regulations further complicates the problem. Those States which for a time elected to do nothing on eradication soon found that their "hermit" policy was about to backfire and that they would soon be barred from out-of-State markets for their livestock. Interstate, regional and national cooperation is essential to the final achievement of the eradication goal.

An outstanding recent achievement of a regional effort was the complete eradication of the screwworm fly from the southeastern States. This could never have been accomplished without complete cooperation among the States involved. This new concept of eradication rather than control will be adapted to more fields in the future. Our past experiences have taught us the value of cooperative effort on a regional and national basis. As extension livestock specialists we will have an increasingly important role to fill in future efforts along these lines.

7. Cooperation with regional research projects

The principles we have been discussing are demonstrated in the Regional Research Projects for beef cattle, swine and sheep. Each State in the North Central Region is represented on these species technical committees which meet annually to review progress and make necessary project adjustments. This system of planning research on a regional basis has largely eliminated duplication of effort as each

State worker is making a specific contribution to a coordinated program. Too many of us are not abreast of the developments coming out of this effort. It seems to me that we should give some thought as to ways we can develop closer liaison with these committees and disseminate their findings throughout the States where it can be used. Our State extension livestock improvement programs can be strengthened and harmonized throughout the region by working more closely with these committees.

8. Inter-regional cooperation

Emphasis areas for interstate cooperation do not always fall within the boundaries of one region. A notable example is the Great Plains Program which embraces part of 10 States in three different Extension Administrative Regions. This is a joint effort involving many disciplines and organizations. It has the broad objective of achieving a more stable agriculture and economy in an area susceptible to severe drouths.

There are also many opportunities for joint cooperation between specialists in several States which have a common problem. Sometimes, these States may be in two or more regions.

The following functions of cooperative effort were paraphrased from the 1959 Great Plains Council report and are steps that are equally applicable to regional or area efforts by livestock specialists:

1. To identify and analyze the problems.
2. To suggest priorities in the attack on problems.
3. To develop possible solutions to selected problems.
4. To appraise the adequacy of existing research, extension and action programs in the area.
5. To promote the adaptation of livestock programs to area conditions.
6. To encourage the development of needed programs.
7. To promote cooperation in a coordinated attack on livestock problems.
8. To provide for and promote the ready exchange of ideas from State to State, from State to federal level and vice versa.

In conclusion, may I say that I have attempted to point out some ideas which might stimulate further thoughts on the subject. I don't claim to have all of the answers. As you follow through in your discussion groups, I hope that you may be able to come up with some practical conclusions. Each of you will probably be thinking of regional efforts in terms of your respective subject matter fields. May I suggest that as you explore the various areas which offer possibilities for cooperative effort on a regional basis, that you also give some thought to the mechanics of achieving cooperation in joint undertakings and evaluate their priorities in your mutual plans.

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"ON THE FARM" PRODUCTION OF SPF SWINE 1/

The Nebraska study on the elimination and control of swine diseases by use of swine repopulation methods is now in its fifth year. Secondary SPF (specific pathogen-free) pigs, i.e. pigs born by natural birth from primary or secondary SPF dams, have been farrowed each spring and fall for six consecutive farrowings, 1958-1960. Excellence of performance has been maintained through successive generations at a level near 200 pounds average weight by five months. In comparison to conventional pigs, SPF have had lower mortality and have converted feed more efficiently.

To meet the need for a means to certify that SPF pigs remain free of certain diseases yet retain genetically desirable traits, a pilot certification program has been initiated at the Nebraska Station. The diseases which the program is designed to eliminate and control are atrophic rhinitis, virus pig pneumonia (VPP), swine dysentery, and brucellosis. Pigs must be free of these diseases to certify as SPF. They must also average 155 lbs. weight by 140 days of age and must carry less than 1.6 inches of backfat to certify. The pilot study is based on 60 farm herds. Thus far, 73 percent of these herds have succeeded in making the requirements.

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1/ Abstract of an illustrated lecture presented by Dr. George Young, Chairman, Department of Veterinary Science, University of Nebraska, Lincoln, Nebr., at North Central Region Livestock Specialists' Conference, Fort Robinson Beef Cattle Research Station, Crawford, Nebr., May 23-25, 1961.

REPORT OF GROUP DISCUSSIONS
Role of Livestock Specialist

Discussion with Dr. Damon Catron (Allied Industry)

College personnel have competition from industry in their teaching function, but colleges have the potential to tie together programs with the problem-solving process in mind. A great need is apparent for more interdisciplinary thinking and action within colleges, and the potential cooperative effort of college and industry personnel should be realized and developed.

Industry and college personnel need to get together and evaluate themselves and each other in order to achieve cooperation. The problem of Extension volunteering its service was discussed. The general feeling was that administrative policy precludes solicitation of our participation in inter-industry programs.

General consensus is that our function is to teach principles in line with change, but teaching of practices has to be balanced into the overall program.

The feed industry should utilize our information but use it accurately and not slanted to sales opportunity. Extension personnel and the University should not be "used" to selfish advantage by industry.

There are certain areas which are developing so rapidly that neither Extension nor industry sales personnel can keep up with them. Neither should act as specialists outside of their own "specialty."

Extension specialists felt that they are available to industry in many areas, but felt that they need to be asked to cooperate in industry programs rather than push themselves onto industry. It is nearly impossible to serve the mass of producers by direct personal contact from Extension, but rather we must utilize the help of industry for best overall results.

Catron quotes:

"One way to correct misunderstanding between Extension and industry is to have industry committees sit with extension personnel and talk problems out, then decide action."

"The feed industry should support university research and university action programs. Industry benefits from university findings and programs as do producers and consumers. The consumer has actually derived the greatest overall benefit."

Discussion with Ralph Raikes (Livestock Producer)

Ralph Raikes:

1. Goes direct to research people for information.
2. Suggested that county lines be disregarded in extension planning and action.

3. Felt that more small, special interest groups (25 to 30) individuals be organized as a method of presenting educational material in "short-course manner."
4. Expressed desire to have area specialists.
5. Suggested county committee that would represent Extension on non-political basis, meet no more than four times a year to guide extension agents programs.

Raikes quotes:

"Don't wait for people to come to you. Everyone is entitled to service, but don't beg them to receive it."

"We have a right to know the truth (information). You give us the truth--we'll make the decision."

Discussion with Director E. W. Janike (Extension Administrator)

Director Janike:

A. Emphasized responsibility to work with adults and youth in livestock production and related areas.

B. Discuss means of meeting the more specialized needs of livestock producers.

   1. Possible methods of organization within the State. Several methods now being used in Nebraska, Ohio, and Missouri were discussed. Each State and each area is an individual situation.

   2. Training necessary to meet these needs.

      a. Advanced formal training.
      b. In-service training.

   3. Need for effective guidance from livestock producers and industry representatives.

C. Summary

   1. Listen to the "Ralph Raikes" as well as to key livestock men working closely with Extension.

   2. Analyze your capabilities.

   3. Work as a team. Visualize the total picture and see how your efforts can fit.

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REPORT OF GROUP SESSION I
(New Approaches in Beef Cattle Programs)

Chairman and Secretary - W. W. Wharton, Ohio

The specialists were particularly interested in the sharing of materials and ideas such as copies of the different State feeding trials, production testing information, procedures and promotion ideas as well as the school series idea.

George Strum, North Dakota, shared his experiences in a promotion idea emphasizing North Dakota barley / North Dakota cattle = beef. His series of slides were professionally prepared and presented. He revealed that he had nearly all of North Dakota behind this excellent project and as he said, "The impact was terrific."

Paul Guyer, Nebraska, described his successful series of meetings on range management and cattle, each involving two four-hour sessions. Several States reported that they had or plan to adopt this teaching procedure in order to provide more detailed information to their cattlemen.

Bill Wharton, Ohio, distributed copies of a newsletter that he is using to maintain closer contact with his Production Testing cooperators. He explained that Ohio has gone to the special training school (with fee) for disseminating detailed information. In Ohio, as other States, the one general livestock meeting per county per year no longer serves the needs of producers. He said, "If we do not provide the detailed information and know-how, the cattleman will go to the source where he can get it . . . if we, as extension specialists consider ourselves as educators . . . let's be educators."

Frank Baker, Oklahoma, wrote to the chairman about a "new approach" in making single-track sound-movies for less than $100 per 10-minute film. He explained that these films had eased the workload of the specialist considerably. The group was very interested in the single-track system where the sound is put on the film at the time of filming.

The remainder of the session led into performance testing, how it was conducted in different States, who did what, changing to electronic calculations, who paid for the IBM, size of programs, who did the summary work and above all . . . did the cattleman understand what he had in 3 or 4 years accumulation of records. Was the specialist getting the job of teaching done that was needed.

It was suggested that we need more uniformity in our performance testing or production testing or record of performance (we don't even have a unified name for "it.") Bill Wharton reported that he was a member of the standing committee on Beef Cattle Improvement and would be most receptive to any ideas to help standardize production testing procedures over the country, particularly in the field of electronic calculations.

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REPORT OF GROUP SESSION II
(New Approaches in Swine Programs)

Chairman - G. R. Carlisle, Illinois
Secretary - M. D. Whiteker, Iowa

Questions raised on the type of publications that best serve our clients.

Short courses:

Purdue conducted five schools dealing with breeding. Limited attendance to 50 persons. County decides who attends. College supplied material. Subjects covered were anatomy, endocrinology, genetics, breeding systems, disease.

Also conducting schools such as this in beef and swine nutrition. Limited to three counties per year.

Iowa provides basic fundamentals. People are registered. Used schools as management service in junction with agricultural economics and management.

Minnesota conducts similar type program.

Missouri - nothing in this area.

James R. Foster, Purdue, presented some slides related to digestion in swine.

South Dakota is preparing the material, training the agents, and letting them present material to farmers.

Discussed aspects in management research.

Fred Giesler, Wisconsin, showed slides on artificial insemination, A.I. bred and naturally bred pigs, and on carcass evaluation.

Wisconsin has two studs --- planning to start A.I. in swine.

Conception rate, litter size, serum storage and charges were discussed.

Robert E. Jacobs, Minnesota, presented slides on swine management and swine production systems.

Swine tours met with no approval.

Publications - ideas presented by different States.

Summary:

Many ideas were exchanged and presented in areas of A.I., short courses, publications, nutrition, and management.

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REPORT OF GROUP SESSION III
(New Approaches in Sheep Programs)

Chairman - James E. Ross, Missouri
Secretary - Delwyn Dearborn, South Dakota

Mayo, Indiana, reported the third lamb carcass show held in connection with the Indiana State Fair was a success. The carcass show is divided into four different classes based on live weight. The carcass contest placing is based on value of 100# of carcass weight. The show also requires 4.4 square inches of loin eye per 100# of carcass weight and the outside fat cover must fall between .25 - .4 inches. Lambs are shorn prior to the show. Mayo reported that smaller shows on a county or area basis may be started in the near future.

Doane, Nebraska, reported that Wyoming, Nebraska and Swift Packing Co., Scottsbluff, Nebr., cooperated in holding a 4-H market lamb show. Each club member exhibits a pen of five lambs. They are graded on foot and later the same day are viewed hanging on the rail. He also reported on the Nebraska ewe distribution program designed to increase the number of sheep producers and offer professional help in the selection of ewes. Doane indicated he planned on continuing the program until the commission firms can do a competent job in carrying the program.

Cate, Illinois, reported that a committee of sheep producers located around the Dixon Springs Station has been organized to supervise lamb and wool pools. The wool pool handled over 41,000 pounds of wool this past year with considerable success.

Kirkeide, North Dakota, reported that North Dakota has had tremendous success in involving all interested organizations in stimulating cattle feeding. This year they plan on promoting hog production and possibly at some later date they will promote sheep production.

Van Stavern, Ohio, reported for Grimshaw from Ohio. He indicated that Grimshaw had good success with a five-session school held once a week for five weeks. These schools were held primarily in the winter time. A fee is charged to each student.

Dearborn, South Dakota, reported that more than 30 ruminant nutrition workshops were held in western South Dakota this past winter. Principles of winter feeding for both beef and sheep were covered. Dearborn also reported on the ram testing work that has been done in South Dakota.

Ross, Missouri, indicated that the programs in Missouri were very similar. He expressed a real concern for the internal parasite opportunity which they have in their State.

Suggestions for new approaches include: intensive educational meetings, more bulletins of a smaller size, more lamb carcass shows and serving lamb at educational event.

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REPORT OF GROUP SESSION IV
(New Approaches in 4-H Livestock Programs)

Chairman and Secretary - D. C. Williams, Jr., Nebraska

Recommendations:

1. That 4-H manuals be written on a graded level (age groups). In the past, 4-H project manuals, in general, have been "above the heads" of younger club members.

2. That more science be injected in the 4-H project work. Project manuals should be written in such a way that they stimulate the imagination of club members. The club member should want to know "why" instead of "how" something is done. He should look further into a situation than just that required to complete his project work.

3. That the 4-H horse project be standardized in so far as rules and regulations for show classes, riding games, etc.

4. That each State re-evaluate each 4-H livestock project to determine if it is practical from the standpoint of sound livestock selection, management and marketing practices.

5. That carcass evaluation be included in 4-H livestock judging, training and contest work.

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REPORT OF GROUP SESSION I
(Regional Efforts in Beef Cattle Programs)

Chairman - George E. Strum, North Dakota
Secretary - Paul Q. Guyer, Nebraska

The group expressed a need for keeping up to date on progress of the regional beef cattle breeding projects. Keith Gregory agreed to include the beef cattle specialists in the region on the Fort Robinson mailing list. North Central Regional Beef Breeding Research Conference reports are preliminary and are not to be quoted or used in publications. They can be used for the specialist's own information and for reporting types of work in progress. Charles Bell offered the services of his office in distributing. Outlines of visuals used or other phases of the project could be sent in accordance with the above.

Bill Zmolek proposed that the responsibility of designing materials on basic information that would be applicable throughout the region be divided among the States in order to minimize duplication of effort and expense. He pointed out that certain types of materials do not lend themselves to mass distribution from the Federal office and must be exchanged by reciprocal agreement of those involved.

Development of standard nomenclature for use in conformation grading of beef cattle in connection with performance programs was discussed at length. The need for presenting the same story is essential to effective extension teaching throughout the Nation. Bill Wharton (Ohio) agreed to discuss this need with the other members of the ASAP Extension Beef Cattle Improvement Committee for the purpose of implementing action towards solution of this problem.

The group expressed a need for an area publication on wintering cattle under range conditions. There is a great deal of information available which should be consolidated into a comprehensive brief publication.

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REPORT OF GROUP SESSION II
(Regional Efforts in Swine Programs)

Chairman - LaVerne J. Kortan, South Dakota
Secretary - Leo E. Lucas, Nebraska

Actions Agreed On

1. Each swine specialist will send a list of all bulletins and training aids available in their State to all swine specialists in the region and a copy to Charlie Bell for use as he sees fit for the other regions.

2. Leo Lucas will distribute information on the Nebraska disease free certification program to each swine specialist.

3. Leo Lucas was named chairman of a committee to develop a uniform regional certification program. The committee will work closely with Dr. Young and other veterinarians concerned to insure a sound and coordinated certification program.

4. There is no specific need for uniform standards for boar testing stations due to differences in management and environment between States.

5. Concensus of group is that adequate summaries of research results are now available in most areas of swine production.

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REPORT OF GROUP SESSION III
(Regional Efforts in Sheep Programs)

Chairman - Don Walker, Illinois
Secretary - Ted H. Doane, Nebraska

We need additional research information in the following areas:

1. Systems of mating (crossbreeding, 3-way crosses, etc.)
2. Carcass information including specifications of meat-type lamb carcasses.
3. Economic factors in production.
4. Creep feeding of lambs - including data on cost and returns.
5. Internal parasite control.
6. Systems of flock management.
7. Re-evaluation of pasture management.
8. Balanced creep rations - pellets.
9. Economics of linear programming as to the number of sheep necessary for a sound sheep program.
10. Practical control of foot rot.
11. Physiology - stimulation of ovulation.
12. Marketing.

    a. Wool - farm flock States.
    b. Lamb pools.
    c. Merchandising lamb - possibility of midwestern markets having locally produced lamb available for a period of 3-6 months.

What Extension Livestock Specialists Can Do

1. Encourage research in suggested areas.
2. Exchange bulletins - letters - slides - etc.
3. Work with neighboring specialists in

    a. Programming.
    b. Writing specific bulletins and assign it to the area where an outstanding researcher is available.

4. Sheep scab eradication programs.

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REPORT OF GROUP SESSION IV
(Regional Efforts in 4-H Livestock Programs)

Chairman - Tom W. Wickersham, Iowa
Secretary - Ray Arthaud, Minnesota

Recommendations:

1. That States be permitted to extract sections of material from 4-H publications of other States for use in writing 4-H manuals without requiring that credit be given to the authors of the extracted material. We feel that it is more desirable for each State to write their own 4-H publications using reference material from other States than for several States to jointly prepare regional bulletins. We further agree that the States should move forward on this without delay.

2. That a list of visual aids and other training material from each State in the region be compiled and distributed. We recommend that Tom Wickersham (Iowa) be responsible for assembling this information from the various States.

3. That the National 4-H Livestock Program Development Subcommittee and Home Economics Committee be asked to give specific recommendations and suggestions on meat identification and judging. This type of activity lends itself to regional effort.

4. That a set of livestock judging slides be developed for duplication and use by the various States. These slides should not be just "placing" slides but should give terms, descriptions, and illustrations on what to look for and consider in selecting and judging livestock.

5. That each State send new publications to all specialists in the surrounding States.

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LIST OF PERSONS IN ATTENDANCE

COLORADO	Colorado State University, Fort Collins, Colo. William R. Culbertson, Extension Animal Husbandman Paul S. Pattengale, Extension Animal Husbandman
ILLINOIS	University of Illinois, Urbana, Ill. G. R. Carlisle, Extension Animal Husbandman Harry G. Russell, Extension Animal Husbandman Donald Walker, Extension Animal Husbandman
	Dixon Springs Experiment Station, Robbs, Ill. H. A. Cate, Extension Animal Husbandman
INDIANA	Purdue University, Lafayette, Ind. Russell Brower, Extension Animal Husbandman James R. Foster, Extension Animal Husbandman Richard Hollandbeck, Extension Animal Husbandman K. G. MacDonald, Extension Animal Husbandman Henry H. Mayo, Extension Animal Husbandman Howell N. Wheaton, Assistant Extension Agronomist
IOWA	Iowa State University, Ames, Iowa R. C. deBaca, Extension Animal Husbandman L. N. Hazel, Professor of Animal Husbandry Maurice Soults, Assistant Director of Extension M. D. Whiteker, Extension Animal Husbandman Tom W. Wickersham, Extension Animal Husbandman William G. Zmolek, Extension Animal Husbandman
	Damon Catron, Vice-president, Walnut Grove Products Co., Inc., Atlantic, Iowa
KANSAS	Kansas State University, Manhattan, Kans. V. E. McAdams, Extension Animal Husbandman Wendell A. Moyer, Extension Animal Husbandman
MICHIGAN	Michigan State University, East Lansing, Mich. A. M. Pearson, Professor of Food Industry (Meats)
MINNESOTA	University of Minnesota, St. Paul, Minn. Ray Arthaud, Extension Animal Husbandman Robert E. Jacobs, Extension Animal Husbandman
MISSOURI	University of Missouri, Columbia, Mo. James W. Burch, Extension Animal Husbandman James E. Ross, Extension Animal Husbandman Homer B. Sewell, Extension Animal Husbandman
NEBRASKA	Ronald E. Stoller, County Agent, Chadron, Nebr. A. Robert Todaro, County Agent, Harrison, Nebr. Ralph Raikes, livestock producer, Ashland, Nebr.

NEBRASKA	University of Nebraska, Lincoln, Nebr. Donald F. Burzlaff, Extension Range Management Specialist Ted H. Doane, Extension Animal Husbandman Paul Q. Guyer, Extension Animal Husbandman E. W. Janike, Director of Extension Service Leo E. Lucas, Extension Animal Husbandman Daniel B. Lutz, Assistant Extension Editor Raymond C. Russell, Extension Supervisor D. C. Williams, Jr., Extension Animal Husbandman Dr. George Young, Chairman, Dept. of Veterinary Science
	Fort Robinson Beef Cattle Research Station, Crawford, Nebr. James S. Ingalls, Superintendent Donald LeFever, Herdsman John Rothlisberger, Herdsman Walter Rowden, Assistant Superintendent Lloyd Tanner, University of Nebraska Museum Richard White, Herdsman James N. Wiltbank, Physiologist
NORTH DAKOTA	North Dakota State University, Fargo, No. Dak. Melvin A. Kirkeide, Extension Animal Husbandman George E. Strum, Extension Animal Husbandman
OHIO	Ohio State University, Columbus 10, Ohio Wilbur H. Bruner, Extension Animal Husbandman Bobby D. Van Stavern, Extension Animal Husbandman William W. Wharton, Extension Animal Husbandman
SOUTH DAKOTA	South Dakota State College, Brookings, So. Dak. LaVerne J. Kortan, Extension Animal Husbandman
	Agricultural Extension Service, Rapid City, So. Dak. Delwyn Dearborn, Extension Animal Husbandman Henry P. Holzman, Extension Animal Husbandman
WISCONSIN	University of Wisconsin, Madison, Wis. Fred Giesler, Extension Animal Husbandman
WYOMING	University of Wyoming, Laramie, Wyo. E. K. Faulkner, Extension Animal Husbandman
USDA	Federal Extension Service, USDA, Washington 25, D. C. Charles E. Bell, Jr., Chief, Animal Industry Branch
	Agricultural Research Service, Beltsville, Md. Clair E. Terrill, Chief, Sheep and Fur Animals Research Branch
	Agricultural Research Service, USDA, University of Nebraska, Lincoln, Nebr. Keith E. Gregory, Regional Coordinator, Beef Cattle Research